MICROCHEMICAL PROCESS MODULE AND AUTONOMOUS DISPERSION TYPE PROCESS PLANT

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Application number: JP19940295747 19941104

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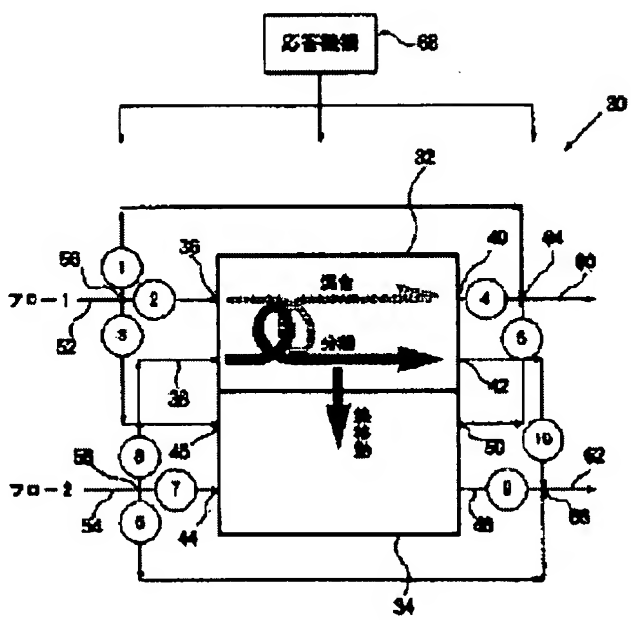
Abstract of **JP8131819**

PURPOSE: To provide both of high flexibility and operation efficiency which can follow up economical fluctuations by executing at least one of heat and material transfer operation between fluids of housing means, splitting operation between the housing means and joining operation of the outflow fluids between two pieces of the housing means.
CONSTITUTION: First, second inlet pipes 2, 7, first, second splitting pipes 3, 8, first, second outlet pipes 4, 9, first, second joining pipes 5, 10, first, second bypass pipes 1, 6 are provided respectively with fluid transporting means, pipe opening and closing means, means for detecting the temps., pressures and characteristics of the fluids flowing in the respective pipes and a flow controller consisting of the assembly of the control means of the transporting and opening and closing means. Then, pain of chambers 32, 34 have microcomputers which are inputted from the respective means and output to the respective means. The chambers have a response mechanism 68 which makes calculation in accordance with the detection data of the detecting means and transmits tokens to the outside of the system by responding to the tokens from the outside of the system. This mechanism responds to the tokens with a conditioned reflex cooperatively with the respective controllers.



Family list
2 family member for: **JP8131819**
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Inventor: KOSHIJIMA ICHIRO; NIIDA KAZUO **Applicant:** CHIYODA CHEM ENG CONSTRUCT CO

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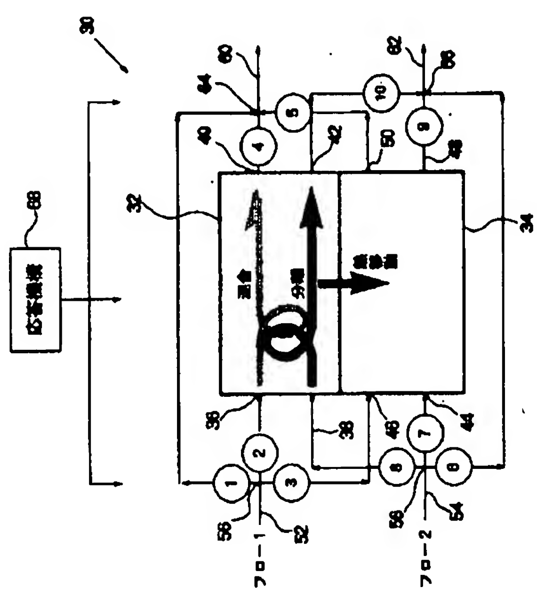
(54)【発明の名称】　マイクロ・ケミカルプロセス・モジュール及び自律式分散型プロセス・プラント

(57)【要約】　（修正有）

【目的】フレキシビリティと経済性とを兼ね備える新規なプロセス・プラントを提供する。

【構成】マイクロ・ケミカルプロセス・モジュール３０は、流体を受入れ、収容し、かつ払い出す少なくともの２個の収容手段３２、３４と、系外から各収容手段に流体を流入させる流入手段２、３、７、８と、各収容手段から流体を系外に流出させる流出手段４、５、９、１０と、バイパス手段１、６と、流入手段、流出手段、及びバイパス手段とにそれぞれ設けられた、輸送機能、開閉機能及びセンサ機能を有する流れ制御装置①等と、系外から到来するターゲット・トークンに対して応答し、流れ制御装置と協働して自律的に行動する応答機構６８とで構成されている。これにより、流体間での熱移動操作、物質移動操作、系外から流入する流体の分流操作、流出する流体の合流操作のうちの少なくとも一つの操作を流入手段と流出手段とを介して２個の収容手段間で行う。



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【特許請求の範囲】

【請求項1】　流体を受入れ、収容し、かつ払い出す少なくともの2個の収容手段と、系外から各収容手段に流体を流入させる流入手段と、各収容手段から流体を系外に流出させる流出手段と、輸送機能、開閉機能及びセンサ機能を有し、流入手段と流出手段とにそれぞれ設けられた流れ制御装置と、系外から到来するターゲット・トークンに対して応答し、流れ制御装置と協働して自律的に行動する応答機構とで構成され、

収容手段に受け入れた流体間での熱移動操作、収容手段に受け入れた流体間での物質移動操作、系外から流入する流体の収容手段間での分流操作、収容手段から流出する流体の合流操作のうちの少なくとも一つの操作を流入手段と流出手段とを介して2個の収容手段間で行うようにしたことを特徴とするマイクロ・ケミカルプロセス・モジュール。

【請求項2】　2個の収容手段が、それぞれ、一方の端部に第1及び第2流入口を、一方の端部に対向して位置する他方の端部に第1及び第2流出口を有する第1及び第2チャンバの対で形成され、

流入手段が、外部から来る第1及び第2流入管に接続及び解除自在にそれぞれ設けられた第1及び第2分岐部と、第1分岐部と第1チャンバの第1流入口とを、及び第2分岐部と第2チャンバの第1流入口とをそれぞれ接続する第1及び第2入口管と、第1分岐部と第2チャンバの第2流入口とを、及び第2分岐部と第1チャンバの第2流入口とをそれぞれ接続する第1及び第2分流管とで形成され、

流出手段が、外部に出る第1及び第2の流出管に接続及び解除自在にそれぞれ設けられた第1及び第2合流部と、第1チャンバの第1流出口と第1合流部とを、及び第2チャンバの第1流出口と第2合流部とをそれぞれ接続する第1及び第2出口管と、第1チャンバの第2流出口と第2合流部とを、及び第2チャンバの第2流出口と第1合流部とをそれぞれ接続する第1及び第2合流管とで形成され、

更に、第1分岐部と第1合流部との間、及び第2分岐部と第2合流部との間には、第1バイパス管及び第2バイパス管が接続され、

第1及び第2入口管、第1及び第2分流管、第1及び第2出口管、第1及び第2合流管並びに第1及び第2バイパス管の各々に設けられた流れ制御装置は、それぞれ、管内を流れる流体の輸送手段と、管を開閉する開閉手段と、管内を流れる流体の温度及び圧力並びに性状を検出するセンサ手段と、輸送手段及び開閉手段を制御する制御手段とを有し、

応答機構が、ターゲット・トークンの情報及びセンサ手段の検出データに基づいて演算し、判断し、制御手段に指令を出し、更に系外にターゲット・トークンを発信する手段を備えていることを特徴とするマイクロ・ケミカルプロセス・モジュール。

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【請求項3】　制御手段が、オン状態とオフ状態のいずれかの指令を輸送手段及び開閉手段に出力することを特徴とする請求項2に記載のマイクロ・ケミカルプロセス・モジュール。

【請求項4】　応答機構が、マイクロ・ケミカルプロセス・モジュールの進退目的地とその経路を自動案内車に指示し、指令に従って自動案内車により搬送され、かつ第1及び第2分岐部をそれぞれ第1及び第2流入管に、第1及び第2合流部をそれぞれ第1及び第2流出管に接続又は接続解除するようにしたことを特徴とする請求項2又は3に記載のマイクロ・ケミカルプロセス・モジュール。

【請求項5】　請求項1から4のうちのいずれか1項に記載の複数個のマイクロ・ケミカルプロセス・モジュールが自律的にかつ個々的に集合し、相互に連結してモジュール集合体を形成し、モジュール集合体が所定のユニット・オペレーションを行うようにしたことを特徴とする自律式分散型プロセスプラント。

【請求項6】　請求項1から4のうちのいずれか1項に記載の複数個のマイクロ・ケミカルプロセス・モジュールが自律的にかつ個々的に集合し、相互に連結してなる複数個のモジュール集合体で構成され、各モジュール集合体が所定のプロセス・フローに基づくユニット・オペレーションをそれぞれ行い、それによって所定のプロセス・フローに基づく一連のプロセッシングを行うようにしたことを特徴とする自律式分散型プロセスプラント。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、マイクロ・ケミカルプロセス・モジュールと、マイクロ・ケミカルプロセス・モジュールの集合体で形成された自律式分散型プロセス・プラントに関するものである。

【0002】

【従来の技術】本明細書で、プロセス・プラントとは、その取り扱う対象が主として流体を形成できる液体及び／又は気体（粉状体、粒状体を含む）であって、機械加工とは対立した概念である化学的なプロセッシングを行うプラントである。従って、プロセス・プラントは、化学工業、パルプ工業、セメント工業等を含む広い分野で使用されるプラントを言う。ところで、概念的にもまた実体的にも、従来のプロセス・プラント（以下、簡単にプラントと言う）は、一つのプロセス・フローを想定し、そのプロセス・フローに基づいて、熱移動及び物質移動を対象とするユニット・オペレーション（単位操作）を行わせる、例えば熱交換器、蒸留塔、気液分離槽等の単一化学機器の組み合わせとして成立している。

【0003】プラントの設計、建設に当たっては、プロセス上及び経済上での最適化設計、社会の経済的変動に応じてプラントを経済的に運転するために必要なオペレ

ーション・フレキシビリティ（プラントを運転する上での融通性及び多様性）、及び高いコスト競争力がプラントの重要な設計目標とされて来た。そこで、従来のプラントの設計手法では、プラントを構成する単一化学機器の各々をプロセス的にかつ経済的に最適化すれば、それらを組み合わせたプラントの全体もプロセス的にかつ経済的に最適化できるとして、単一化学機器の最適化を図って来た。プラントのオペレーション・フレキシビリティを大きくするために、スループット、製品及び原料の仕様を変えた多数回のケース・スタディを行い、その結果から所謂設計マージンを決定し、最適化された各機器の仕様に設計マージンを加味してきた。また、高いコスト競争力を得るために、規模の利益を求めてプラントを大型化して来た。

【0004】

【発明が解決しようとする課題】しかし、プロセス・フローに基づいて、必要なユニット・オペレーションを行う単一化学機器を採用し、各単一化学機器の最適化を行い、それらを組み合わせて一つのプラントを構成すると言う従来のプラント構成概念に従って構成されたプラントには、以下のような問題を包含している。第1には、経済性を追求した結果としてプラントを大型化したが、現実には、需要と供給との関係から低いスループットで、しかも、設計時の予定限界を越えた低いスループットでその大型プラントを運転せざるを得ないことが多いと言うことである。これでは、プラントを大型化して経済性を求めた意味がない。それは、一般に、プラントが、後続のプラントと連動して運転されているからである。例えば、そのプラントの都合だけでスループットを決めて、そのスループットでプラントを運転したり、逆にそのプラントの都合だけでプラントの運転を停止したりすることはできない。特に、この制約は、コンビナートを形成する場合に顕著である。

【0005】仮に、プラントの運転条件の変動を考慮して、各単一化学機器に設計マージンをそれぞれ加味していたとしても、その設計マージンの限界を越えて運転条件を変えざるを得ない場合には、この手法も効果が無い。例えば、運転時のスループットが設計スループットの50％である場合には、その運転費用は設計スループットの70％時の費用を要すると言われている。以上のように、個々の単一化学機器が、プラント設計時に定められたユニット・オペレーションに基づいて最適な寸法、仕様に設計、製作されたものであったとしても、運転時ではもはや最適な設計でなくなり、従って、プラントがコスト競争力を失っている。

【0006】第2には、各単一化学機器の機能が固定されているために、単一化学機器同士間で機能を相互に交換したり、ユニット・オペレーションの順序を変えたりすることはできない。例えば、気液分離槽を熱交換器として使用することは現実にはできない。従って、プラントの構成が固定されているために、プロセッシングの順序、即ちプロセス・フローを自在に変更することが難しい。換言すれば、オペレーション・フレキシビリティの程度が、その固定されたプロセス・フローと各単一化学機器の独立性により制限されている。これでは、原料及び製品が益々多様化しつつある現在、その多様化の状況に追随できないことを意味する。

【0007】第3には、プラントの運転制御の問題である。運転条件の変動が設計マージンの限界内であったとしても、変動した運転条件下でプラントを運転するためには、プラントを構成する全ての単一機器に対して或る運転条件、望ましくは最適な運転条件を決定することが必要である。そのためには、プロセス・コンピュータを備えて、複雑なプロセス計算を行い、プロセス計算の結果に基づいて、プロセス全体を監視し、かつ制御できる制御システムを構築することが必要である。しかし、プロセス・コンピュータが著しく発展したとしても、プラント全体を監視し、制御する制御システムはそれが依拠する制御プログラムを必要とし、その制御プログラムはプロセスエンジニアとプラグラマの個人的能力と協同作業によって開発、維持されなければならない。従って、プラントを構成する機器毎に最適な運転条件を算出して各機器をその条件で制御することは、そのような広範囲の変数を制御できる能力を有する人間の介在が必要となる以上、実現不可能と言ってよいほどに実際には困難なことである。これでは、プラント設計に当たり、設計マージンを付与する意味が無くなる。

【0008】以上、説明したように、プロセス・フローを構成するユニット・オペレーション毎に単一化学機器を割当て、その機器を最適化することにより、プラント全体を最適化しようとする従来の手法では、高いフレキシビリティと高い経済性とは相互に二律背反の要求となり、双方を同時に満足させることはできない。従って、従来の手法が、高いフレキシビリティと高い経済性とを兼ね備えたプラント、即ち社会の急激な経済的発展に伴う様々な要求を満足できるプラントを提供し得ないと言うことが明確になりつつある。しかも、プラントに付随する環境問題、エネルギー問題を考えると、良い環境を保全する上で、また使用エネルギーの削減化を図る上で、プラントのプロセス的かつ経済的最適化は、極めて重要なことである。

【0009】以上の状況に照らして、本発明の目的は、社会の経済的変動に追随できる高いフレキシビリティと高い運転効率とを兼ね備える新規なプロセス・プラントを提供することである。

【0010】

【課題を解決するための手段】本発明者等は、上記目的を達成するためには、従来のプラントとは概念の異なる新規なプラントが必要であると考え、状況に応じて必要な機能を発揮できる多機能型のマイクロ・ケミカルプロ

セス・モジュールを考案し、かかるマイクロ・ケミカルプロセス・モジュールを構成単位としてそれを集合することによりプラントを構成できることに着目し、本発明を完成するに至った。

【0011】上記目的を達成するために、この知見に基づき、本発明に係るマイクロ・ケミカルプロセス・モジュールは、流体を受入れ、収容し、かつ払い出す少なくともの2個の収容手段と、系外から各収容手段に流体を流入させる流入手段と、各収容手段から流体を系外に流出させる流出手段と、輸送機能、開閉機能及びセンサ機能を有し、流入手段と流出手段とにそれぞれ設けられた流れ制御装置と、系外から到来するターゲット・トークンに対して応答し、流れ制御装置と協働して自律的に行動する応答機構とで構成され、収容手段に受け入れた流体間での熱移動操作、収容手段に受け入れた流体間での物質移動操作、系外から流入する流体の収容手段間での分流操作、収容手段から流出する流体の合流操作のうちの少なくとも一つの操作を流入手段と流出手段とを介して2個の収容手段間で行うようにしたことを特徴としている。

【0012】本明細書で、ターゲット・トークンとは、機能及び条件に関する情報を携えて系外から到来して、マイクロ・ケミカルプロセス・モジュールにその情報を入力し、そのターゲット・トークンを得たマイクロ・ケミカルプロセス・モジュールは、所定の操作に参加権を得ることができるものである。また、自律的とは、人間の指示によることなく、マイクロ・ケミカルプロセス・モジュール自身の規範、又は基準により行動することを言う。本発明において、例えば、収容手段は容器であり、流入手段及び流出手段はパイプであり、輸送機能はマイクロ・ポンプであり、開閉機能は開閉弁であり、センサ機能は温度計、圧力計等のセンサである。

【0013】本発明の好適な実施態様は、2個の収容手段が、それぞれ、一方の端部に第1及び第2流入口を、一方の端部に対向して位置する他方の端部に第1及び第2流出口を有する第1及び第2チャンバの対で形成され、流入手段が、外部から来る第1及び第2流入管に接続及び解除自在にそれぞれ設けられた第1及び第2分岐部と、第1分岐部と第1チャンバの第1流入口とを、及び第2分岐部と第2チャンバの第1流入口とをそれぞれ接続する第1及び第2入口管と、第1分岐部と第2チャンバの第2流入口とを、及び第2分岐部と第1チャンバの第2流入口とをそれぞれ接続する第1及び第2分流管とで形成され、流出手段が、外部に出る第1及び第2の流出管に接続及び解除自在にそれぞれ設けられた第1及び第2合流部と、第1チャンバの第1流出口と第1合流部とを、及び第2チャンバの第1流出口と第2合流部とをそれぞれ接続する第1及び第2出口管と、第1チャンバの第2流出口と第2合流部とを、及び第2チャンバの第2流出口と第1合流部とをそれぞれ接続する第1及び第2合流管とで形成され、更に、第1分岐部と第1合流部との間、及び第2分岐部と第2合流部との間には、第1バイパス管及び第2バイパス管が接続され、第1及び第2入口管、第1及び第2分流管、第1及び第2出口管、第1及び第2合流管並びに第1及び第2バイパス管の各々に設けられた流れ制御装置は、それぞれ、管内を流れる流体の輸送手段と、管を開閉する開閉手段と、管内を流れる流体の温度及び圧力並びに性状を検出するセンサ手段と、輸送手段及び開閉手段を制御する制御手段とを有し、応答機構が、ターゲット・トークンの情報及びセンサ手段の検出データに基づいて演算し、判断し、制御手段に指令を出し、更に系外にターゲット・トークンを発信する手段を備えていることを特徴としている。

【0014】本発明の更に好適な実施態様は、制御手段が、オン状態とオフ状態のいずれかの指令を輸送手段及び開閉手段に出力することを特徴としている。ここで、オン状態とは、動作状態にあることを言い、例えば輸送手段は流体を輸送できる状態にあり、開閉手段は開状態にあり、センサ手段は検出可能な状態にあることを言い、オフ状態とはそれぞれがオン状態とは逆の状態にあることを意味する。

【0015】本発明の更に好適な実施態様は、応答機構が、マイクロ・ケミカルプロセス・モジュールの進退目的地とその経路を自動案内車に指示し、指令に従って自動案内車により搬送され、かつ第1及び第2分岐部をそれぞれ第1及び第2流入管に、第1及び第2合流部をそれぞれ第1及び第2流出管に接続又は接続解除するようにしたことを特徴としている。

【0016】また、本発明に係る自律式分散型プラントは、請求項1から4のうちのいずれか1項に記載の複数個のマイクロ・ケミカルプロセス・モジュールが自律的にかつ個々的に集合し、相互に連結してモジュール集合体を形成し、モジュール集合体が所定のユニット・オペレーションを行うようにしたこと特徴としている。ユニット・オペレーションとは、熱移動、物質移動を伴う単一の操作を言い、例えば、熱交換、分流、合流、吸収、混合、気液分離等のプロセス上の操作を言う。

【0017】更に、本発明に係る別の自律式分散型プラントは、請求項1から4のうちのいずれか1項に記載の複数個のマイクロ・ケミカルプロセス・モジュールが自律的にかつ個々的に集合し、相互に連結してなる複数個のモジュール集合体で構成され、各モジュール集合体が所定のプロセス・フローに基づくユニット・オペレーションをそれぞれ行い、それによって所定のプロセス・フローに基づく一連のプロセッシングを行うようにしたことを特徴としている。

【0018】

【作用】請求項1に記載の発明では、収容手段、流入手段、流出手段、流れ制御装置及び応答機構を備えて、独立的にかつ自律的に行動し、少なくとも一つのプロセス

操作を行うことのできる単一化学機器としての構成単位を形成する。

【0019】請求項5及び6に記載の発明では、複数個のマイクロ・ケミカルプロセス・モジュールが独立して自律的にかつ個々的に集合し、相互に連結して、集合体を形成し、その集合体がそれぞれ所定のユニット・オペレーションを行うことにより、自律式分散型プラントを構成する。

【0020】

【実施例】以下、添付図面を参照し、実施例に基づいて本発明をより詳細に説明する。

実施例1

図1は、本発明に係るマイクロ・ケミカルプロセス・モジュールの実施例1の構成を示す図である。本実施例のマイクロ・ケミカルプロセス・モジュール（以下、簡単にモジュールと略称する）３０は、同じ構造の方形の箱体であって、相互に面同士で面接触している対の第１チャンバ３２と第２チャンバ３４とを備えている。第１チャンバ３２は、入口端部に第１流入口３６及び第２流入口３８を、入口端部に対向して位置する出口端部に第１流出口４０及び第２流出口４２を備えている。第２チャンバ３４も同様に第３流入口４４、第４流入口４６、第３流出口４８及び第４流出口５０を備えている。

【0021】モジュール３０には、フロー１の流体及びフロー２の流体をそれぞれ流入させる第１流入管５２及び第２流入管５４が外部から入来し、かつ第１流入管５２及び第２流入管５４にそれぞれ第１分岐部５６及び第２分岐部５８が解除自在に接続している。また、モジュール３０からは、第１流出管６０及び第２流出管６２が外部に出ており、かつ第１流出管６０及び第２流出管６２には第１合流部６４及び第２合流部６６が解除自在に接続している。

【0022】第１入口管２及び第１分流管３が、第１分岐部５６と第１チャンバ３２の第１流入口３６とを及び第１分岐部５６と第２チャンバ３４の第４流入口４６とをそれぞれ接続している。同様に、第２入口管７及び第２分流管８が、第２分岐部５８と第２チャンバ３４の第３流入口４４とを及び第２分岐部５８と第１チャンバ３２の第２流入口３８とをそれぞれ接続している。更に、第１出口管４及び第１合流管５が、第１チャンバ３２の第１流出口４０と第１合流部６４とを、及び第２チャンバ３４の第４流出口５０と第１合流部６４とをそれぞれ接続している。同様に、第２出口管９及び第２合流管１０が、第２チャンバ３４の第３流出口４８と第２合流部６６とを、及び第１チャンバ３２の第２流出口４２と第２合流部６６とをそれぞれ接続している。また、第１バイパス管１及び第２バイパス管６が、それぞれ、第１分岐部５６と第１合流部６４とを、及び第２分岐部５８と第２合流部６６とを接続し、第１チャンバ３２及び第２チャンバ３４をバイパスしている。

【0023】第１及び第２入口管２、７、第１及び第２分流管３、８、第１及び第２出口管４、９、第１及び第２合流管５、１０、第１バイパス管１及び第２バイパス管６の各々には、それぞれ、流体を輸送する輸送手段（例えば、ポンプ）と、管を開閉する開閉手段（例えば、開閉弁）と、管内を流れる流体の温度及び圧力並びに性状を検出する検出手段（例えば、センサ）と、輸送手段及び開閉手段を制御する制御手段との集合からなる流れ制御装置（以下、ＦＣＵと表記する）が設けてある。輸送手段等の各手段は、それぞれ、例えば、太陽電池、燃料電池等により自立的にエネルギーを調達して動作するようになっている。図１では、第１バイパス管１に設けられた流れ制御装置を①で表示している。以下、各管に設けられた流れ制御装置についても同様である。

【0024】更に、対のチャンバ３２、３４は、各手段から入力され、また各手段に出力するマイクロコンピュータを備え、検出手段の検出データに基づいて演算し、系外から到来するトークンに対して応答し、更に系外にトークンを発信する応答機構６８を備えている。マイクロコンピュータは、予めプログラムが入力されており、それに基づいて、演算動作、判断動作、指令の発信動作等を行う。尚、本実施例では、応答機構６８は、各ＦＣＵと協働して後述のトークンに条件反射的に２値的判断を行い、２値的な応答を行うだけで複雑な判断を行わない。ここで、条件反射的に応答する（反射応答）とは、複雑な論理を思考することなく、オン状態又はオフ状態、有又は無等の２値状態で条件反射的に応答することである。また、制御手段は、応答機構６８より指令を受けて、オン状態とオフ状態のいずれかの指令を輸送手段及び開閉手段に出力するようになっている。図１では、自立機構６８から各手段への接続が模式的に表示されている。

【0025】以上のように構成されたモジュール３０は、任意の寸法で形成して良いが、モジュール３０を集合して一つの単一化学機器、更にはプラントを構成すると言う概念からはミニチュア化されるのが一般である。

【0026】反射応答の様式には、モジュール３０内で生じる内部的反射応答とモジュール３０から系外に発信される外部的反射応答とがあり、実施例１を例にしてそれぞれの典型的な反射応答を以下に挙げる。

内部的反射応答１

内部的反射応答１は、入口ＦＣＵに対する出口ＦＣＵの反射応答であって、流入するフローの閉塞を排除することであると規定される。よって、オン状態の入口ＦＣＵとオン状態の出口ＦＣＵとの次のような組み合わせがある。オン状態とは、動作状態にあることを言い、例えばＦＣＵのポンプは運転状態にあり、開閉弁は開状態にあり、センサは検出可能な状態にあることを言い、オフ状態とはポンプ、開閉弁及びセンサがそれぞれオン状態とは逆の状態にあることを意味する。

オン状態の入口ＦＣＵ	オン状態の出口ＦＣＵ
2及び／又は8	4及び／又は10
3及び／又は7	5及び／又は9

【0027】内部的反射応答2

内部的反射応答2は、入口ＦＣＵ及び出口ＦＣＵの排他的反射応答であって、流入するフローの分離を行わないし、また2個の流出フローの混合を行わないことである＊＊と規定される。よって、オン／オフ状態のＦＣＵに対応するオフ／オン状態とＦＣＵの次のような組み合わせがある。

オン／オフ状態のＦＣＵ	オフ／オン状態のＦＣＵ
2	3
4	5
7	8
9	10

【0028】外部的反射応答1

外部的反射応答1は、近隣モジュールに対する反射応答であって、各モジュールはその出口条件を検知することによりその運転上の制約条件を維持できるかどうかを判断する。或るモジュールが、運転上の制約条件がその能力を越えていることを認識した時、そのモジュールは近隣モジュールに条件の逸脱を後述するトークンによりアナウンスする。これにより、近隣モジュール間で反射応※※答の一連の進行、即ち反射応答の伝播が引き起こされる。反射応答を独立に引き起こすには次の2個の指定条件、即ち量的条件と質的条件があり、それに対して対応する反射応答の伝播がある。逸脱した条件の例は、逸脱した量的条件及び質的条件の例である。シードモジュールが同時に双方の条件を検出すると、直列、並列及び直列・並列増殖の3様の増殖様式の一つを不規則的に引き起こす。

指定条件	反射応答の伝播	逸脱した条件の例
量的条件	並列伝播	流量
質的条件	直列伝播	温度、組成

【0029】外部的反射応答2

外部的反射応答2は、モジュール機能に関する反射応答であって、増殖したモジュールの機能が、反射応答を引き渡すモジュールの機能を2重写しすることであると規定されている。モジュールの機能は、最初の反射応答前、即ち当初モジュールに設定された時点で、後述する表1に示すパイプライン1の機能であるが、本外部的反射応答2によって、要請された機能に変態する。

【0030】外部的反射応答3

外部的反射応答3は共通資源に関する反射応答であって、モジュールの各出口フロー及びユーティリティが、共通資源であると指定されている。第1のモジュールは全ての必要な資源を入手することができる。

【0031】表1は、上述の2種類の様式の内部的反射応答に基づくモジュールの機能チャートを示す。

【表1】

モジュール機能	フロー制御ユニット番号									
	フロー1					フロー2				
	1	2	3	4	5	6	7	8	9	10
パイプライン1	オン									
パイプライン2						オン				
パイプライン3	オン					オン				
パイプライン4		オン		オン						
パイプライン5		オン								オン
パイプライン6			オン		オン					
パイプライン7			オン						オン	
パイプライン8					オン		オン			
パイプライン9							オン		オン	
パイプライン10				オン				オン		
パイプライン11								オン		オン
混合器1		オン		オン				オン		
混合器2		オン						オン		オン
混合器3			オン		オン		オン			
混合器4			オン				オン		オン	
熱交換器1		オン		オン			オン		オン	
熱交換器2		オン			オン		オン			オン
熱交換器3			オン	オン				オン	オン	
熱交換器4			オン		オン			オン		オン
フラッシュ・ドラム1		オン		オン						オン
フラッシュ・ドラム2			オン		オン				オン	
フラッシュ・ドラム3					オン		オン		オン	
フラッシュ・ドラム4				オン				オン		オン
吸収器1		オン		オン				オン		オン
吸収器2			オン		オン		オン		オン	

表1に示すモジュール30は、熱移動、物質移動、分離、混合の機能を有している。表1によれば、ＦＣＵを組み合わせることにより、1個のモジュール30から、11種類の態様のパイプラインと、4種類の態様の混合器と、4種類の熱交換器と、4種類のフラッシュ・ドラムと、2種類の吸収器とが形成される。フラッシュ・ドラム機能を有する複数のモジュールを使用して通常の蒸留塔を容易に実現することができる。

【0032】図2は、境界における制約を検出したシードモジュールに対する反射応答の直列及び並列増殖を模式的に示している。この反射応答では、ターゲット・トークン（以下、簡単にトークンと略称する）がコミュニケーション・プロトコルとして伝播される。トークンは、シードモジュールによって発信された、モジュール機能と指定条件に関する情報を携えている。モジュールがトークンを受け取った時、モジュールは、トークンに携えられた情報通りに、その機能及び条件を2重写しする。全ての条件が増殖したモジュールにより満足された時、トークンは停止し、反射応答の伝播が終了する。モジュール間での外部的反射応答のこのような伝播及び停止は、自律的組織構成機構を形成し、人の介在を必要とする集中制御システム無しに自律的にシステム構造を構築する。尚、情報通信分野でトークンとは、トークンを捕獲した通信装置が、送信権を獲得すると言う意味で使用されているが、本明細書では、ターゲット・トークンとは、機能及び条件に関する情報を携え、そのターゲット・トークンを得たモジュールが参加権を得るようなものである。反射応答とは、複雑な判断を要することなく条件反射的に応答することを言う。

【0033】容量が小さく、効率が低いために、単一のモジュールだけでは与えられたプロセス上の要求を満足できなくても、増殖機構によって大群のモジュールを集めることにより、プロセス上の要求を満足させることができる。モジュールの大多数は、増殖機構の下で最高の効率で運転されるので、自律式分散型プラントは、最適条件下で運転されていない従来型プラントより、常に、高い総合効率で運転されることができる。

【0034】モジュールは、自立的駆動装置、例えば太

陽電池を動力源とする、ジェット噴射式駆動装置を備えて移動できるようにしても良い。また、モジュールを移動し、かつモジュール間でパイプラインを接続するロボットアームを有する自動案内車両（Automatic Guided Vehicle、ＡＧＶ）をモジュールとは別に用意して、それでモジュールを移動させ、かつ流入管及び流出管に接続させるようにしても良い。図３は、コンピュータ・グラフィクス・システムで描いた自律式分散型プラントの概念図である。

【００３５】以上の構成により、モジュール３０は、チャンバ３２とチャンバ３４により、それぞれ独立したパイプラインを構成してフロー１とフロー２とを輸送し、またフロー１及びフロー２との間の物質移動を行わせ、更にチャンバ３２及びチャンバ３４の間でフロー１とフロー２との間の熱移動を行わせることができる。物質移動は、例えばフロー１及びフロー２中の物質の混合、フロー１及びフロー２の物質の分離を含む、蒸留、吸収操作を意味する。換言すれば、モジュール３０は、状況に応じて必要な物質移動機能及び／又は熱移動機能を果たす多機能型のモジュールであって、例えばパイプライン、混合槽、フラッシュドラム、吸収器、熱交換器の作用をそれぞれ行うことができ、更には、複数のモジュール３０が集合して自律的に組織を構成し、大型の単一化学機器を構成できる。また、モジュール３０が集合して、一つの別のユニット・オペレーション、例えばフラッシュ・ドラム態様のモジュール３０が連続して接続することにより蒸留塔の作用を行うことができる。

【００３６】実施例２

本実施例は、モジュールが熱交換機能を発揮する、即ち熱交換器として機能する例である。図４は、モジュールMが条件の変動に応じてシードモジュール（図４では、Seedと表示されている）になる様子を説明する図である。１個のモジュールMの伝熱面積は０．３m² 、伝熱面の総括伝熱係数は８３７×１０³ J/m²hr°C である。ユーティリティ熱源から供給された温度１００°C、比熱０．８J/kg°C の高温側フロー１と、温度４０°C 、比熱０．８J/kg°Cの低温側フロー２とが、モジュールMに流入する。当初状態①では、フロー１及びフロー２の各流量は、同じ１００kg/hr とする。このような条件下で、フロー２の出口温度は６１．５°C となる。尚、モジュールM周りの条件は、図８に示す凡例に従って表示されている。以上の事を整理すると、

条件番号	項目	指定条件
条件１	フロー１の流量	１００kg/hr
条件２	フロー２の流量	１００kg/hr
条件３	フロー２の出口温度	６１．５°C

【００３７】フロー２の流量が１４０kg/hr に増大して状態②になった時、フロー２の出口温度は６１．５°C から５６．１°C に低下する。この場合、モジュールMは、はフロー２の流量が条件２より増大し、出口温度が条件３より低下した境界条件を検出する。条件２及び３を維持するために、モジュールMは、シードモジュールとなり、当初の機能と指定条件、即ち熱交換機能と条件１から条件３までの情報を携えたトークンを発信する。この状態を③で表示する。シードモジュールのトークンに対する反射応答は、直列反射増殖、並列反射増殖及び直列・並列反射増殖の３様の反射応答である。以下、順次、説明する。

【００３８】直列反射増殖様式

直列反射増殖の進行は、図５に示されている。シードモジュールがトークンを発信し、Ｓ－１モジュールがトークンを受け取る。トークンを受けたＳ－１モジュールは、熱交換機能の遂行に参加するべく、シードモジュールの後に直列に接続する。しかし、Ｓ－１モジュールの接続だけでは、出口温度条件を満足できない（測定温度６０．３°C ＜目的温度６１．５°C ）ので、Ｓ－１モジュールはトークンを発信し、Ｓ－２モジュールがトークンを受け取り、熱交換機能の遂行に参加するべく、Ｓ－１モジュールの後に直列に接続する。このようにして、モジュールの直列反射増殖が進行し、Ｓ－３モジュールが熱交換機能の遂行に参加した段階で、条件３が満足されるので（測定温度６１．７°C ＞目的温度６１．５°C ）、モジュールの直列反射増殖が停止する。

【００３９】並列反射増殖様式

並列反射増殖の進行は、図６に示されている。シードモジュールはトークンを発信する一方、シードモジュールはその能力を維持するためにフロー１の流量を１００kg/hr に保持している。Ｐ－１モジュールがそのトークンを受け取ると、シードモジュールはその当初状態①に立ち返り、状態②におけるフロー２の流量のうちシードモジュールに流入した残りの流量、４０kg/hr と条件１のフロー１の流量、１００kg/hr がＰ－１モジュールに流入する。従って、フロー１の全流量は、２００kg/hr になる。この結果、Ｐ－１モジュールの出口温度は８１．４°C になり、シードモジュールの出口温度６１．５°C の流出体と混合すると、６７．２°C の温度になり条件３を満足する。よって、条件２及び３が解消され、モジュールの並列反射増殖はここで停止する。

【００４０】直列・並列反射増殖様式

直列・並列反射増殖の進行は、図７に示されている。シードモジュールは２個のトークンを発信し、シードモジュールの近隣のＳ－１モジュールとＰ－１モジュールとがトークンを受け取る。多数の反射応答を禁止する通信手段がＳ－１モジュールとＰ－１モジュールとの間で規定されていないので、上述のトークンの授受は、不規則な反射応答メカニズムのもとで行われる。Ｓ－１モジュールの運転条件は、並列反射増殖におけるシードモジュールにＳ－１モジュールが直列に接続した時の運転条件であり、Ｐ－１モジュールの運転条件は、並列増殖におけるＰ－１モジュールの運転条件と同じである。Ｓ－１

モジュールの出口温度は65．7°Cになるから、S－1モジュールとP－1モジュールとからそれぞれ流出したフロー2を混合した後の温度は、70．2°Cになり、条件3を満足する。このようにして、条件2及び条件3が解消される。反射増殖の後、シードモジュールは当初の状態①に戻って並列反射増殖の場合と同じ状態になり、S－1モジュールの熱交換機能を必要とすることなく条件2及び条件3が解消される。その結果、S－1モジュールは、付加的なモジュールになる。換言すれば、入口条件がトークンに携えられた条件に合致することを検出した時、S－1モジュールはそれ自身の機能をパイプラインに変更する。

【0041】この実施例では、出口境界で指定条件からの逸脱を解消するために、上述した3様の増殖様式が自律的に作り出される。システムは、個別的に不連続で成長するので、全ての解が全ての品質上の拘束条件に合致してそれを満足できるわけではない。例えば、上述の各解の出口温度は、61．7°C、67．2°C及び70．2°Cであって、当初条件の出口温度、61．5°Cに等しくない。経済的には、直列増殖又は並列増殖を選択する上でモジュールの数とユーティリティの消費量との間でトレード・オフの関係を考慮することが必要である。運転上の観点からは、直列・並列増殖が最大のマージンを有している。従って、局所的及び静的にはいずれの増殖様式が最良のシステムであるか決めるのは難しい。

【0042】実施例3

実施例3は、自律式分散型プラントの設計思想を説明する例である。先ず、従来のユニット・オペレーションの設計手法を使用して、所定の原料、製品の仕様、運転条件に基づき、図9（a）に示すような基本的なプロセス・フローを規定する。本プロセス・フロー80は、熱交換器82、フラッシュ・ドラム84、蒸留塔86、凝縮器88、溜め槽90、及び再沸器92を備えている。本プロセス・フロー80では、原料を熱交換器82で昇温した後、フラッシュ・ドラム84でフラッシュさせて気体状の塔頂成分と液体状の塔底成分とに分離し、双方を蒸留塔86に供給する。蒸留塔86では、塔頂留分を凝縮器88で凝縮させた後、溜め槽90に受け、その一部を蒸留塔86に還流し、その残りを系外に送出する。蒸留塔86の塔底では、塔底留分の一部を再沸器92で気化させて、還流作用と協動して供給された原料の蒸留を行う。

【0043】上述の熱交換器82等のユニット・オペレーション用の各機器及びそれを接続すう各配管は、それぞれ実施例1に示すモジュール30と同じ構成を備えた一組のマイクロ・ケミカルプロセス・モジュール（以下、モジュールと略称する）の集合として図9（b）に示すように分解できる。図9（b）では、各モジュールは、各ます目1個が1個のモジュールと同じ大きさの格子状の目盛線で描かれた2次元平面に配置されている。

【0044】上述のようにしてモジュールを集合、配列した後、原料の流量が設計時の所定流量より増加した場合には、シードモジュールの周りの近隣モジュールは、実施例2で説明した増殖様式に従って、図9（c）に示すように増殖し、制限を解消して、指定条件を満足するように自律的に行動して組織を再構築する。これにより、自律式分散型プラントは、集中制御システムを必要とすることなく、全ての外的な条件の変化に応答して、その内部的システム構造を自律的に構築する能力を得ることができる。

【0045】

【発明の効果】請求項1の発明によれば、各モジュールに等しく収容手段、流入手段、流出手段、流れ制御装置及び応答機構を備えることにより、状況に応じて必要な物質移動機能及び／又は熱移動機能を果たす多機能型であってかつ自律的に集合、増殖できるマイクロ・ケミカルプロセス・モジュールを実現している。マイクロ・ケミカルプロセス・モジュールが自律的に増殖、集合して大型化することにより、任意の状況下で必要な処理量を所定通り処理できるケミカルプロセス用単位機器が実現される。請求項5及び6の発明によれば、マイクロ・ケミカルプロセス・モジュールを集合させたモジュール集合体を構成することにより、社会の経済的変動に追随できるフレキシビリティの高いプロセス・プラントであって、しかも経済性の高いプラント、換言すれば設計条件下ではなく、その時に与えられた任意の条件の下で常に最高効率で運転できる自律式分散型プラントを実現している。よって、本発明に係る自律式分散型プラントは、原料及び製品の性状が変動し、かつスループットも変動する場合の生産プラントとして最適である。

【図面の簡単な説明】

【図1】本発明に係るマイクロ・ケミカルプロセス・モジュールの実施例1の構成を示す図である。

【図2】限界を検出したシードモジュールに対する反射応答の直列及び並列増殖を模式的に示している。

【図3】コンピュータ・グラフィクス・システムで描いた自律式分散型プラントの概念図である。

【図4】モジュールMが条件の変動に応じてシードモジュールになる様子を説明する図である。

【図5】直列反射増殖の進行を示す図である。

【図6】並列反射増殖の進行を示す図である。

【図7】直列・並列反射増殖の進行を示す図である。

【図8】図4から図8に関する凡例を示した図である。

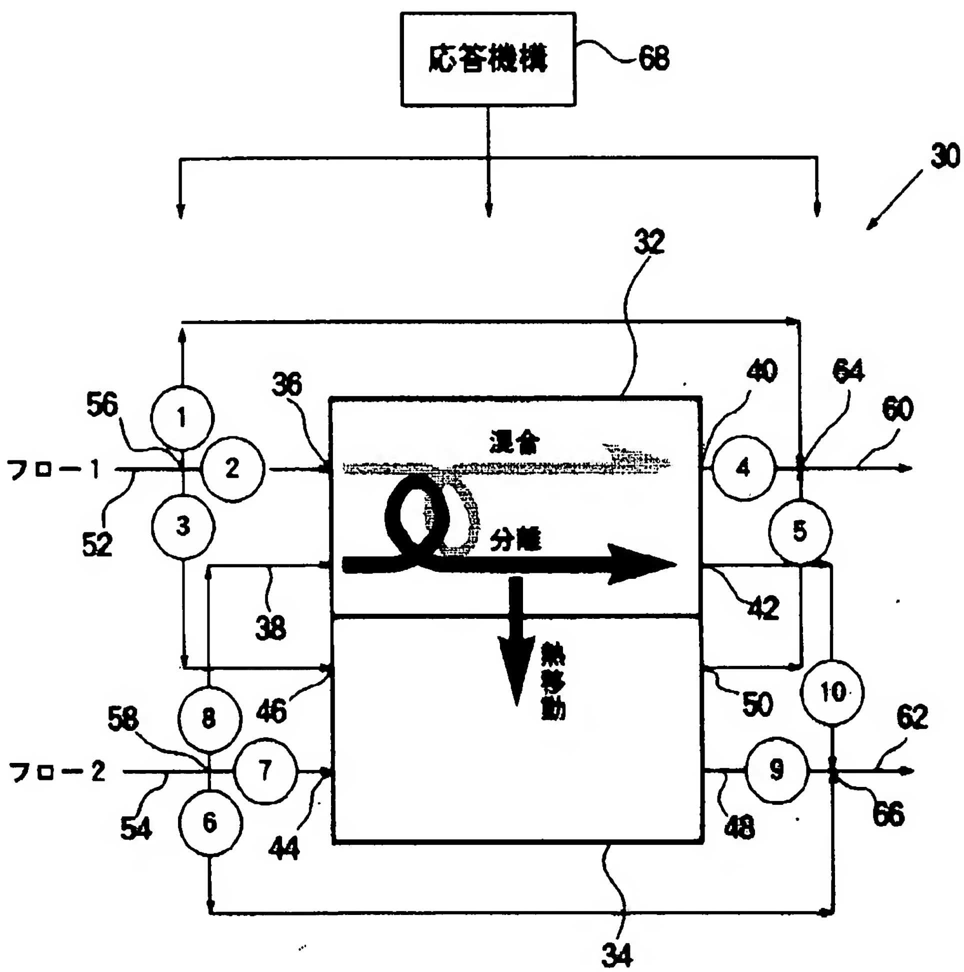
【図9】図9（a）、（b）及び（c）はそれぞれ自律式分散型プラントの設計思想を説明する図である。

【符号の説明】

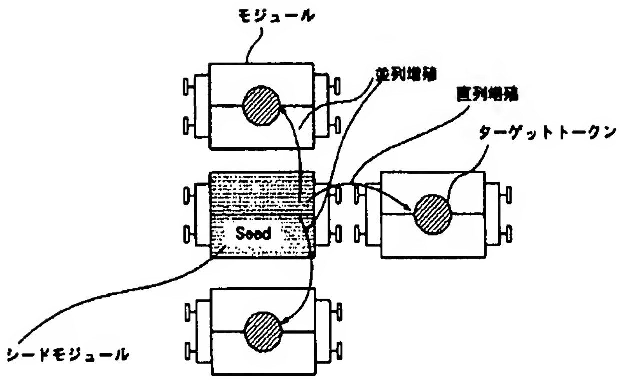
1　第1バイパス管
2　第1入口管
3　第1分流管

4 第1出口管
5 第1合流管
6 第2バイパス管
7 第2入口管
8 第2分流管
9 第2出口管
10 第2合流管
30 マイクロ・ケミカルプロセス・モジュール
32 第1チャンバ
34 第2チャンバ
36 第1流入口
38 第2流入口
40 第1流出口
42 第2流出口
44 第3流入口
46 第4流入口
48 第3流出口
50 第4流出口
52 第1流入管
54 第2流入管
56 第1分岐部
58 第2分岐部
60 第1流出管
62 第2流出管
64 第1合流部
66 第2合流部
80 プロセス・フローの一例
82 熱交換器
84 フラッシュ・ドラム
86 蒸留塔
88 凝縮器
90 溜め槽
92 再沸器

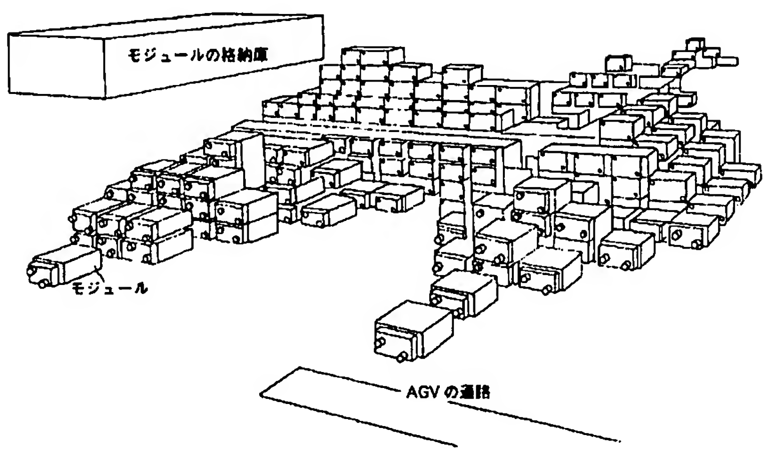
【図1】



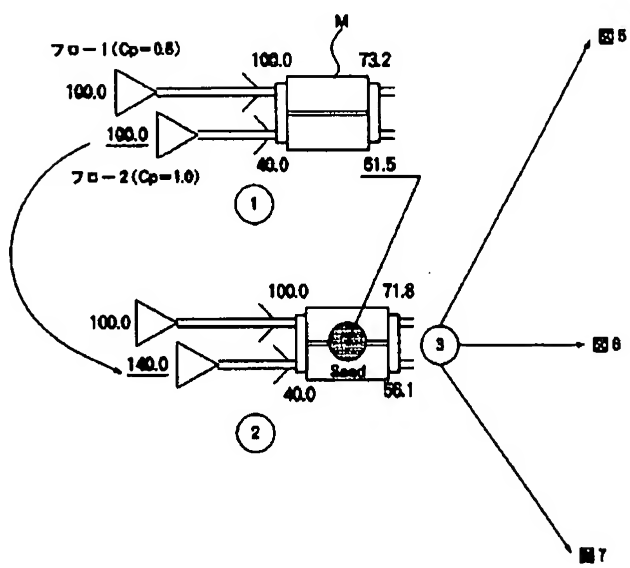
【図2】


モジュール
並列増殖
直列増殖
ターゲットトークン
Seed
シードモジュール

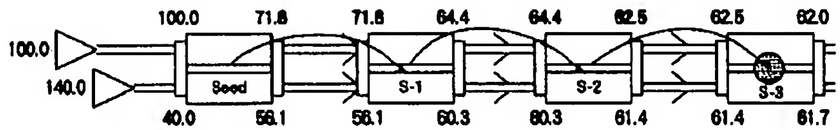
【図3】


モジュールの格納庫
モジュール
AGVの通路

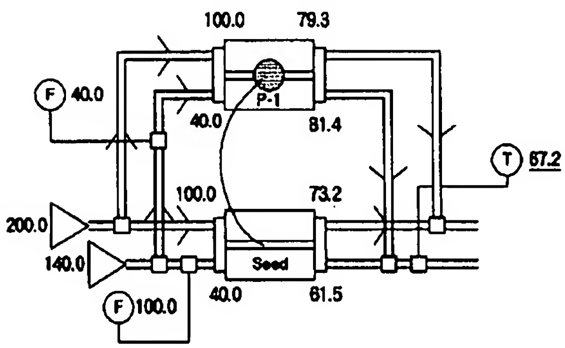
【図4】


M
フロー1(Cp=0.8)
100.0
73.2
100.0
100.0
40.0
61.5
フロー2(Cp=1.0)
1
100.0
71.8
100.0
140.0
Seed
40.0
56.1
2
3
図5
図6
図7

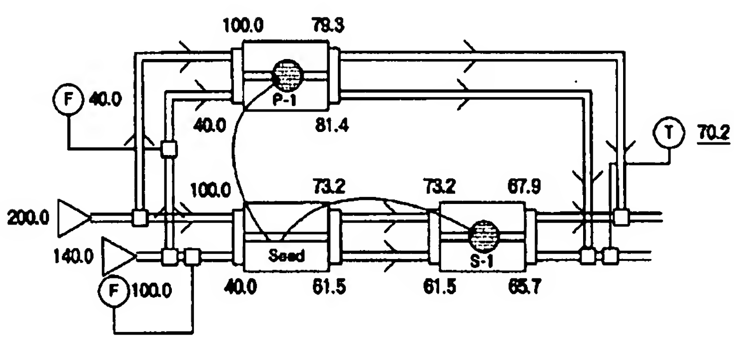
【図5】


100.0
140.0
100.0
71.8
71.8
64.4
64.4
62.5
62.5
62.0
Seed
S-1
S-2
S-3
40.0
56.1
56.1
60.3
60.3
61.4
61.4
61.7

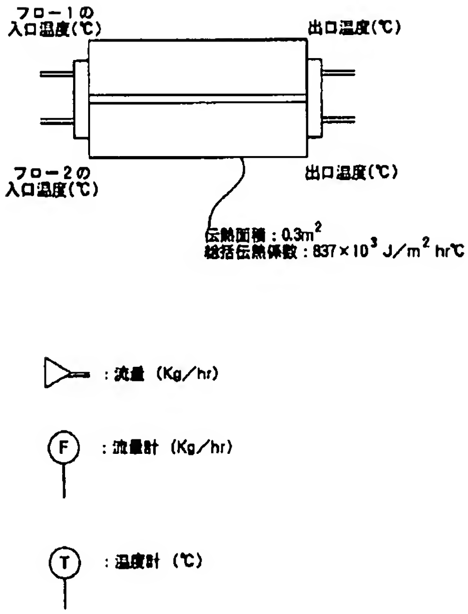
【図6】


100.0
79.3
F
40.0
P-1
40.0
81.4
T
67.2
100.0
73.2
200.0
140.0
Seed
40.0
61.5
F
100.0

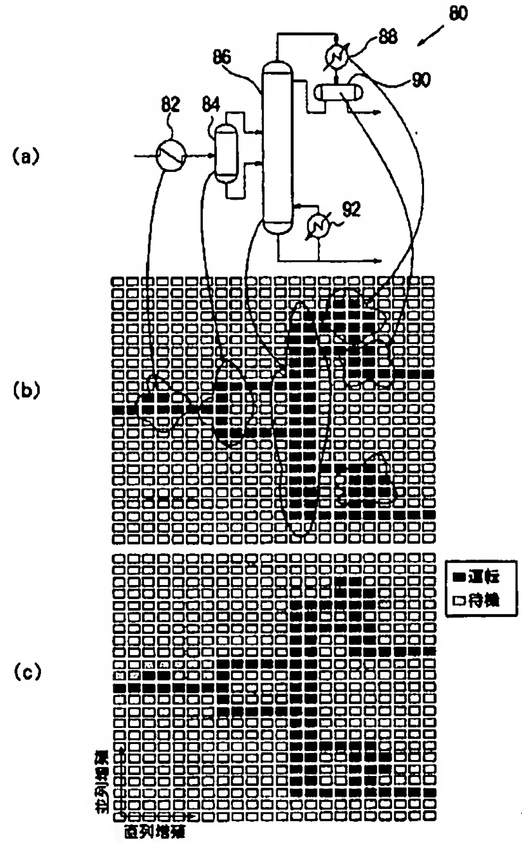
【図7】


100.0
79.3
F
40.0
P-1
40.0
81.4
T
70.2
100.0
73.2
73.2
67.9
200.0
140.0
Seed
S-1
F
100.0
40.0
61.5
61.5
65.7

【図８】


フロー１の
入口温度(℃)
出口温度(℃)
フロー２の
入口温度(℃)
出口温度(℃)
伝熱面積：0.3m²
総括伝熱係数：837×10³ J/m² hr℃
：流量 (Kg/hr)
F
：流量計 (Kg/hr)
T
：温度計 (℃)

【図９】


80
82
84
86
88
90
92
(a)
(b)
(c)
■運転
□待機
並列増殖
直列増殖

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Receive and hold a fluid, and pay out, and when few, the hold means of two things, An inflow means to make a fluid flow into each hold means from the outside of a system, and an outflow means to make a fluid flow out of each hold means out of a system, The flow control unit which has a transportation function, a closing motion function, and sensor ability, and was formed in the inflow means and the outflow means, respectively, It consists of transponder styles which answer from the outside of a system to the coming target token, collaborate with a flow control unit, and act autonomously. The heat transfer actuation between the fluids received in the hold means, the mass transfer operation between the fluids received in the hold means, The micro chemical process module characterized by performing at least one actuation in the splitting actuation between the hold means of the flowing fluid, and unification actuation of the fluid which flows out of a hold means between two hold means through an inflow means and an outflow means from the outside of a system.
[Claim 2] Two hold means at one edge, respectively the 1st and 2nd input It is formed in the other-end section countered and located in one edge by the pair of the 1st and 2nd chambers which has the 1st and 2nd tap holes. The 1st and 2nd tees by which the inflow means was formed in the 1st and 2nd inhalant canals which come from the outside free [connection and discharge], respectively, The 1st and 2nd inlet pipes which connect the 1st tee, the 1st input of the 1st chamber, and the 2nd tee and the 1st input of the 2nd chamber, respectively, It is formed with the 1st and the 2nd minute flow tube which connect the 1st tee, the 2nd input of the 2nd chamber, and the 2nd tee and the 2nd input of the 1st chamber, respectively. The 1st and 2nd unification section by which the outflow means was formed in the 1st and 2nd excurrent canals which come out outside free [connection and discharge], respectively, The 1st and 2nd outlet pipes which connect the 1st tap hole and the 1st unification section of the 1st chamber, and the 1st tap hole and the 2nd unification section of the 2nd chamber, respectively, It is formed by the 1st and 2nd pipe with collectors which connect the 2nd tap hole and the 2nd unification section of the 1st chamber, and the 2nd tap hole and the 1st unification section of the 2nd chamber, respectively. furthermore, between the 1st tee and the 1st unification section and between the 2nd tee and the 2nd unification section The 1st by-path pipe and the 2nd by-path pipe are connected. The 1st and 2nd inlet pipes, The flow control unit formed in the 1st and the 2nd minute flow tube, the 1st and 2nd outlet pipes, and the 1st and 2nd pipe-with-collector list at each of the 1st and 2nd by-path pipes A closing motion means to open and close the transportation means of flowing fluid, and tubing for the inside of tubing, respectively, A sensor means to detect description for the inside of tubing in the temperature and the pressure list of flowing fluid, Have the control means which controls a transportation means and a closing motion means, and a transponder style calculates based on the information on a target token, and the detection data of a sensor means. The micro chemical process module characterized by having a means to judge, to take out a command to a control means and to send a target token out of a system further.
[Claim 3] The micro chemical process module according to claim 2 with which a control means is characterized by outputting either command of an ON state and an OFF state to a transportation means

and a closing motion means.
[Claim 4] The micro chemical process module according to claim 2 or 3 with which a transponder style directs the attitude destination and path of a micro chemical process module to an automatic guide wheel, and is conveyed by the automatic guide wheel according to a command, and is characterized [the 1st and 2nd tees] for the 1st and 2nd unification section by connection or carrying out connection release at the 1st and 2nd excurrent canals at the 1st and 2nd inhalant canals, respectively.
[Claim 5] The autonomous type distributed process plant where it gathers autonomously and in each, and two or more micro chemical process modules given in any 1 term of the claims 1-4 connect mutually, form a module aggregate, and are characterized by a module aggregate performing predetermined unit operation.
[Claim 6] The autonomous type distributed process plant where two or more micro chemical process modules given in any 1 term of the claims 1-4 are characterized by gathering autonomously and in each, consisting of two or more module aggregates which it comes to connect mutually, and for each module aggregate performing unit operation based on a predetermined process flow, respectively, and performing a series of processing based on a predetermined process flow by it.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the autonomous type distributed process plant formed with the aggregate of a micro chemical process module and a micro chemical process module.
[0002]
[Description of the Prior Art] On these specifications, process plants are the liquid with which the object to deal with can mainly form a fluid, and/or a gas (a powdery part and a granule are included), and machining is a plant which performs chemical processing which is the opposing concept. Therefore, a process plant says the plant used in a large field including the chemical industry, pulp industry, a cement industry, etc. By the way, also ontically supposing one process flow, based on the process flow, the conventional process plant (simply henceforth a plant) made the unit operation (unit operation) for heat transfer and mass transfer perform, for example, is notional materialized as a combination of single chemistry devices, such as a heat exchanger, a distilling column, and a vapor-liquid-separation tub.
[0003] If in charge of the design of a plant, and construction, operation flexibility (versatility and versatility when operating a plant) required in order to operate a plant economically according to the optimization design on a process and economy and social economical fluctuation, and high cost competitiveness have been made into the important design objective of a plant. So, by the design technique of the conventional plant, optimization of a single chemistry device has been attained noting that the whole plant which combined them can also be optimized in process and economically, if each of the single chemistry device which constitutes a plant is optimized in process and economically. In order to enlarge operation flexibility of a plant, many case studies which changed the specification of a throughput, a product, and a raw material were performed, the so-called design margin was determined from the result, and the specification of each optimized device has been seasoned with the design margin. Moreover, in order to acquire high cost competitiveness, the plant has been enlarged in quest of economies of scale.
[0004]
[Problem(s) to be Solved by the Invention] However, based on a process flow, the single chemistry device which performs required unit operation is adopted, each single chemistry device is optimized, and the following problems are included in the plant constituted according to the conventional plant construct referred to as constituting one plant combining them. Although the plant was enlarged as a result of having pursued economical efficiency, in the 1st, it is a low throughput from the relation between need and supply actually, and is the large-sized plant's being operated by the low throughput beyond the schedule limitation at the time of a design in many cases, and saying moreover. Now, there is no semantics which enlarged the plant and searched for economical efficiency. Generally that is because a plant is interlocked with a consecutive plant and operated. For example, a throughput is decided only on account of the plant, by the throughput, a plant cannot be operated or operation of a plant cannot be conversely suspended only on account of the plant. Especially this constraint is remarkable when forming industrial complex.

[0005] This technique is also ineffective when a service condition must be changed across the limitation of that design margin, even if it has seasoned each single chemistry device with the design margin in consideration of fluctuation of the service condition of a plant, respectively. For example, when the throughput at the time of operation is 50% of a design throughput, it is said that the operating cost requires o'clock of costs 70% of a design throughput. As mentioned above, even if each single chemistry device is based on the unit operation defined at the time of a plant engineering design and is designed and manufactured by the optimal dimension and the specification, in the time of operation, it stops being already the optimal design therefore, and the plant has lost cost competitiveness.
[0006] Since the function of each single chemistry device is being fixed, functions cannot be mutually exchanged among single chemistry devices, or sequence of unit operation cannot be changed into the 2nd. For example, it cannot perform actually using a vapor-liquid-separation tub as a heat exchanger. Therefore, since the configuration of a plant is being fixed, it is difficult to change free, the sequence, i.e., the process flow, of processing. If it puts in another way, extent of operation flexibility is restricted by the fixed process flow and the independence of each single chemistry device. Now, it means that it cannot follow in footsteps of the situation of current [which a raw material and a product are diversifying increasingly], and its diversification.
[0007] It is the problem of the operation control of a plant the 3rd. Even if fluctuation of a service condition was in the limitation of a design margin, in order to operate a plant under the changed service condition, it is required to determine a certain service condition and the optimal desirable service condition to all the single devices that constitute a plant. For that purpose, it is required to build the control system which is equipped with a process computer, performs complicated process calculation, and supervises the whole process based on the result of process calculation, and can be controlled. However, even if a process computer develops remarkably, an entire plant is supervised, the control system to control needs the control program with which it is based, and the control program must be developed and maintained by the process engineer, plug Lamaism's individual capacity, and collaboration. Therefore, the thing which constitute a plant and for which the optimal service condition is computed for every device, and each device is controlled by the condition is a thing difficult so in fact that you may say that implementation is impossible, if mediation of human being who has the capacity which can control such a wide range variable is needed at all. Now, the semantics which gives a design margin is lost in a plant engineering design.
[0008] As mentioned above, as explained, by [which constitute a process flow] optimizing allocation and its device for a single chemistry device for every unit operation, high flexibility and high economical efficiency can serve as a demand of an antinomy mutually, and coincidence cannot be made satisfied with the conventional technique of optimizing an entire plant of both sides. Therefore, it is becoming clear to say that the plant where the conventional technique combines high flexibility and high economical efficiency, i.e., the plant with which can be satisfied of various demands accompanying social rapid economical development, cannot be offered. And when preserving a good environment, and when considering the environmental problem and energy problems which accompany a plant attaining reduction-ization of the energy used, it is the process thing [economical optimization] of a plant very.
[0009] It is offering the new process plant which combines the high flexibility to which the purpose of this invention can follow in footsteps of social economical fluctuation in the light of the above situation, and high operation effectiveness.
[0010]
[Means for Solving the Problem] this invention person etc. thinks that the new plant where a concept differs from the conventional plant is required in order to attain the above-mentioned purpose, devises the micro chemical process module of the multifunctional mold which can demonstrate a required function according to a situation, and came to complete this invention paying attention to the ability to be able to constitute a plant by gathering it by making this micro chemical process module into a configuration unit.
[0011] In order to attain the above-mentioned purpose, based on this knowledge, the micro chemical process module concerning this invention Receive and hold a fluid, and pay out, and when few, the hold

means of two things, An inflow means to make a fluid flow into each hold means from the outside of a system, and an outflow means to make a fluid flow out of each hold means out of a system, The flow control unit which has a transportation function, a closing motion function, and sensor ability, and was formed in the inflow means and the outflow means, respectively, It consists of transponder styles which answer from the outside of a system to the coming target token, collaborate with a flow control unit, and act autonomously. The heat transfer actuation between the fluids received in the hold means, the mass transfer operation between the fluids received in the hold means, It is characterized by performing at least one actuation in the splitting actuation between the hold means of the flowing fluid, and unification actuation of the fluid which flows out of a hold means between two hold means through an inflow means and an outflow means from the outside of a system.

[0012] On these specifications, it can come from the outside of a system with the information about a function and conditions, the information can be inputted into a micro chemical process module, and, as for a target token, the micro chemical process module which obtained the target token can acquire a participating right to predetermined actuation. Moreover, it says acting by the own norm of a micro chemical process module or criteria, without basing that it is autonomous on directions of human being. In this invention, a hold means is a container, an inflow means and an outflow means are pipes, a transportation function is a micropump, a closing motion function is a closing motion valve, and sensor ability is sensors, such as a thermometer and a pressure gage.

[0013] Two hold means the suitable embodiment of this invention at one edge, respectively the 1st and 2nd input It is formed in the other-end section countered and located in one edge by the pair of the 1st and 2nd chambers which has the 1st and 2nd tap holes. The 1st and 2nd tees by which the inflow means was formed in the 1st and 2nd inhalant canals which come from the outside free [connection and discharge], respectively, The 1st and 2nd inlet pipes which connect the 1st tee, the 1st input of the 1st chamber, and the 2nd tee and the 1st input of the 2nd chamber, respectively, It is formed with the 1st and the 2nd minute flow tube which connect the 1st tee, the 2nd input of the 2nd chamber, and the 2nd tee and the 2nd input of the 1st chamber, respectively. The 1st and 2nd unification section by which the outflow means was formed in the 1st and 2nd excurrent canals which come out outside free [connection and discharge], respectively, The 1st and 2nd outlet pipes which connect the 1st tap hole and the 1st unification section of the 1st chamber, and the 1st tap hole and the 2nd unification section of the 2nd chamber, respectively, It is formed by the 1st and 2nd pipe with collectors which connect the 2nd tap hole and the 2nd unification section of the 1st chamber, and the 2nd tap hole and the 1st unification section of the 2nd chamber, respectively. furthermore, between the 1st tee and the 1st unification section and between the 2nd tee and the 2nd unification section The 1st by-path pipe and the 2nd by-path pipe are connected. The 1st and 2nd inlet pipes, The flow control unit formed in the 1st and the 2nd minute flow tube, the 1st and 2nd outlet pipes, and the 1st and 2nd pipe-with-collector list at each of the 1st and 2nd by-path pipes A closing motion means to open and close the transportation means of flowing fluid, and tubing for the inside of tubing, respectively, A sensor means to detect description for the inside of tubing in the temperature and the pressure list of flowing fluid, It has the control means which controls a transportation means and a closing motion means, a transponder style calculates and judges based on the information on a target token, and the detection data of a sensor means, a command is taken out to a control means, and it is characterized by having a means to send a target token out of a system further.

[0014] The still more suitable embodiment of this invention is characterized by a control means outputting either command of an ON state and an OFF state to a transportation means and a closing motion means. It says that an ON state is in operating state here, for example, a transportation means is in the condition that a fluid can be conveyed, and a closing motion means is in an open condition, it says that a sensor means is in a detectable condition, and an OFF state means that it is in the condition that each is contrary to an ON state.

[0015] A transponder style directs the attitude destination and path of a micro chemical process module to an automatic guide wheel, and is conveyed by the automatic guide wheel according to a command, and the still more suitable embodiment of this invention is characterized [the 1st and 2nd tees] for the 1st and 2nd unification section by connection or carrying out connection release at the 1st and 2nd

excurrent canals at the 1st and 2nd inhalant canals, respectively.
[0016] Moreover, two or more micro chemical process modules given in any 1 term of the claims 1-4 gather autonomously and in each, connect the autonomous type distributed plant concerning this invention mutually, it forms a module aggregate, and the module aggregate is being [made to perform predetermined unit operation / it] characterized by it. Unit operation means the single actuation accompanied by heat transfer and mass transfer, for example, means the actuation on processes, such as heat exchange, splitting, unification, absorption, mixing, and vapor liquid separation.
[0017] Furthermore, another autonomous type distributed plant concerning this invention Two or more micro chemical process modules of a publication gather autonomously and in each in any 1 term of the claims 1-4. Consist of two or more module aggregates which it comes to connect mutually, and each module aggregate performs unit operation based on a predetermined process flow, respectively. It is characterized by performing a series of processing based on a predetermined process flow by it.
[0018]
[Function] In invention according to claim 1, it has a hold means, an inflow means, an outflow means, a flow control unit, and a transponder style, and acts in independent and autonomously, and the configuration unit as a single chemistry device which can perform at least one process actuation is formed.
[0019] When two or more micro chemical process modules gather independently autonomously and in each, connect mutually, and form the aggregate and the aggregate performs predetermined unit operation, respectively, an autonomous type distributed plant consists of invention given in claims 5 and 6.
[0020]
[Example] Hereafter, with reference to an accompanying drawing, this invention is explained more to a detail based on an example.
Example 1 drawing 1 is drawing showing the configuration of the example 1 of the micro chemical process module concerning this invention. The micro chemical process module (it is hereafter called a module for short simply) 30 of this example is the box of the rectangle of the same structure, and is mutually equipped with a pair of 1st chamber 32 and 2nd chamber 34 which are carrying out field contact in fields. The 1st chamber 32 equips with the 1st tap hole 40 and the 2nd tap hole 42 the outlet edge which counters an inlet-port edge and is located in an inlet-port edge in the 1st input 36 and the 2nd input 38. The 2nd chamber 34 is similarly equipped with the 3rd input 44, the 4th input 46, the 3rd tap hole 48, and the 4th tap hole 50.
[0021] The 1st inhalant canal 52 and the 2nd inhalant canal 54 into which the flüid of a flow 1 and the fluid of a flow 2 are made to flow, respectively carried out Iriki to the module 30 from the outside, and the 1st tee 56 and the 2nd tee 58 have connected with the 1st inhalant canal 52 and the 2nd inhalant canal 54 free [discharge], respectively. Moreover, from the module 30, the 1st excurrent canal 60 and the 2nd excurrent canal 62 have come out outside, and the 1st unification section 64 and the 2nd unification section 66 have connected with the 1st excurrent canal 60 and the 2nd excurrent canal 62 free [discharge].
[0022] The 1st inlet pipe 2 and the 1st minute flow tube 3 reached the 1st tee 56 and the 1st input 36 of the 1st chamber 32, and have connected the 1st tee 56 and the 4th input 46 of the 2nd chamber 34, respectively. Similarly, the 2nd inlet pipe 7 and the 2nd minute flow tube 8 reached the 2nd tee 58 and the 3rd input 44 of the 2nd chamber 34, and have connected the 2nd tee 58 and the 2nd input 38 of the 1st chamber 32, respectively. Furthermore, the 1st outlet pipe 4 and the 1st pipe with collector 5 have connected the 1st tap hole 40 and the 1st unification section 64 of the 1st chamber 32, and the 4th tap hole 50 and the 1st unification section 64 of the 2nd chamber 34, respectively. Similarly, the 2nd outlet pipe 9 and the 2nd pipe with collector 10 have connected the 3rd tap hole 48 and the 2nd unification section 66 of the 2nd chamber 34, and the 2nd tap hole 42 and the 2nd unification section 66 of the 1st chamber 32, respectively. Moreover, the 1st by-path pipe 1 and the 2nd by-path pipe 6 connect the 1st tee 56, the 1st unification section 64, and the 2nd tee 58 and the 2nd unification section 66, and are bypassing the 1st chamber 32 and the 2nd chamber 34, respectively.

[0023] To each of the 1st and 2nd inlet pipes 2 and 7, the 1st and the 2nd minute flow tubes 3 and 8, the 1st and 2nd outlet pipes 4 and 9, the 1st and 2nd pipe with collectors 5 and 10, the 1st by-path pipe 1, and the 2nd by-path pipe 6 A transportation means (for example, pump) to convey a fluid, respectively, and a closing motion means to open and close tubing (for example, closing motion valve), The flow control unit (it is hereafter written as FCU) which consists of a set with a detection means (for example, sensor) to detect description for the inside of tubing in the temperature and the pressure list of flowing fluid, and the control means which controls a transportation means and a closing motion means is formed. Each means, such as a transportation means, supplies energy independently with a solar battery, a fuel cell, etc., and operates, respectively. At drawing 1 , the flow control unit formed in the 1st by-path pipe 1 is displayed by **. The same is said of the flow control unit hereafter formed in each tubing.
[0024] Furthermore, a pair of chambers 32 and 34 were equipped with the microcomputer which it is inputted from each means and outputted to each means, they were calculated based on the detection data of a detection means, answered to the token which comes from the outside of a system, and are equipped with the transponder style 68 which sends a token out of a system further. The program is inputted beforehand and a microcomputer performs operation actuation, decision actuation, dispatch actuation of a command, etc. based on it. In addition, at this example, the transponder style 68 does not make a complicated judgment only by [each] collaborating with FCU, making a binary judgment on the below-mentioned token in conditioned reflex, and performing a binary response. here -- a conditioned reflex --- like -- answering (reflective response) -- it is answering in conditioned reflex by binary condition, such as an ON state or an OFF state, **, or nothing, without thinking of [complicated logic]. Moreover, a control means outputs either command of an ON state and an OFF state to a transportation means and a closing motion means in response to a command from the transponder style 68. In drawing 1 , the connection with each means from an erection mechanism 68 is displayed typically.
[0025] Although the module 30 constituted as mentioned above may be formed with the dimension of arbitration, it is general to gather a module 30 and to be miniature-ized from one single chemistry device and the concept referred to as to constitute a plant further.
[0026] The format of a reflective response has the internal reflective response produced within a module 30, and the external reflective response sent out of a system from a module 30, an example 1 is made into an example and each typical reflective response is listed to below.
It is specified that the internal reflective response 1 internal reflective response 1 is a reflective response of the outlet FCU to an inlet port FCU, and is eliminating lock out of the flowing flow. Therefore, there is the following combination of the inlet port FCU of an ON state and the outlet FCU of an ON state. An ON state means that it is in operating state, for example, the pump of FCU has it in operational status, a closing motion valve has it in an open condition, it means that a sensor is in a detectable condition, and, as for an OFF state, a pump, a closing motion valve, and a sensor mean that it is in a condition contrary to an ON state, respectively.
Inlet port FCU of an ON state Outlet FCU of an ON state 2 and/or 8 4 and/or 10 3 and/or 7 5 and/or 9
[0027] It is specified that the internal reflective response 2 internal reflective response 2 is an exclusive reflective response of an inlet port FCU and Outlet FCU, and is not separating the flowing flow and not mixing two outflow flows. Therefore, there is the following combination of the OFF/ON state corresponding to FCU of ON/OFF state, and FCU.
FCU of ON/OFF state FCU of OFF/ON state 2 3 4 5 7 8 9 10 [0028] The external reflective response 1 external reflective response 1 is a reflective response to a neighboring module, and judges whether each module can maintain the constraint on the operation by detecting the outlet condition. When a certain module has recognized that the constraint on operation is over the capacity, the module is announced by the token which mentions deviation of conditions later to a neighboring module. Thereby, a series of advance of a reflective response, i.e., propagation of a reflective response, is caused by the neighboring inter module. There are following two assignment conditions, i.e., quantitative conditions, and qualitative conditions in causing a reflective response independently, and there is propagation of a reflective response which corresponds to it. The example of the conditions from which it deviated is an example of the quantitative conditions from which it deviated, and qualitative conditions. If a seed

module detects both conditions to coincidence, it will cause in [the growth format of Mr. three of a serial, juxtaposition, and serial-parallel growth / one] irregular.
Assignment conditions Propagation of a reflective response Example of the conditions from which it deviated Quantitative conditions Juxtaposition propagation Flow rate Qualitative conditions Serial propagation Temperature, presentation [0029] It is specified that the external reflective response 2 external reflective response 2 is a reflective response about a module function, and is that the function of the increased module carries out the double counterpart of the function of the module which hands over a reflective response. Although a modular function is a pipeline's 1 function shown in Table 1 mentioned later when it is set as a module before the first reflective response (i.e., at the beginning), it metamorphoses into the demanded function by this external reflective response 2.
[0030] The external reflective response 3 external reflective response 3 is a reflective response about a common resource, and it is specified that each modular outlet flow and a modular utility are a common resource. The 1st module can obtain all required resources.
[0031] Table 1 shows the functional chart of the module based on two kinds of above-mentioned internal reflective responses of a format.
[Table 1]

モジュール機能	フロー制御ユニット番号									
	フロー1					フロー2				
	1	2	3	4	5	6	7	8	9	10
パイプライン1	オン									
パイプライン2						オン				
パイプライン3	オン					オン				
パイプライン4		オン		オン						
パイプライン5		オン								オン
パイプライン6			オン		オン					
パイプライン7			オン						オン	
パイプライン8					オン		オン			
パイプライン9							オン		オン	
パイプライン10				オン				オン		
パイプライン11								オン		オン
混合器1		オン		オン				オン		
混合器2		オン						オン		オン
混合器3			オン		オン		オン			
混合器4			オン				オン		オン	
熱交換器1		オン		オン			オン		オン	
熱交換器2		オン			オン		オン			オン
熱交換器3			オン	オン				オン	オン	
熱交換器4			オン		オン			オン		オン
フラッシュ・ドラム1		オン		オン						オン
フラッシュ・ドラム2			オン		オン				オン	
フラッシュ・ドラム3					オン		オン		オン	
フラッシュ・ドラム4				オン				オン		オン
吸収器1		オン		オン				オン		オン
吸収器2			オン		オン		オン		オン	

The module 30 shown in Table 1 has the function of heat transfer, mass transfer, separation, and mixing.

combining FCU according to Table 1 -- one module 30 to 11 kinds of voice -- a pipeline [like] and four kinds of voice -- a mixer [like], four kinds of heat exchangers, four kinds of flash drums, and two kinds of absorbers are formed. The usual distilling column is easily realizable using two or more modules which have a flash drum function.
[0032] Drawing 2 shows typically the serial of a reflective response and juxtaposition growth to the seed module which detected the constraint in a boundary. In this reflective response, a target token (it is hereafter called a token for short simply) spreads as a communication protocol. The token carries the information about the module function and the assignment conditions of having been sent with the seed module. When a module receives a token, a module carries out the double counterpart of the function and conditions as the information carried by the token. When satisfied [with the module which all the conditions increased], it stops and propagation of a reflective response ends a token. Such propagation and a halt of the external reflective response by the inter module form an autonomous organization configuration device, and build a system structure without the integrated control system which needs people's mediation autonomously. The module which obtained the target token seems in addition, to acquire a participating right with the information concerning [a target token] a function and conditions on these specifications by information and communication fields, although the communication device with which the token captured the token is used in the semantics referred to as acquiring a transmission right. A reflective response means answering in conditioned reflex, without requiring complicated decision.
[0033] Even if capacity is small and it cannot satisfy the demand on the process given only by the single module since effectiveness was low, the demand on a process can be satisfied by collecting the modules of a large herd according to a growth device. Since a modular large majority is operated at the highest effectiveness in the bottom of a growth device, an autonomous type distributed plant can always be operated with high overall efficiency from the conventional-type plant which is not operated under optimum conditions.
[0034] A module is equipped with the jet injection type driving gear which makes a self-supporting driving gear, for example, a solar battery, the source of power, and you may enable it to move it. Moreover, the automatic guidance car (Automatic Guided Vehicle, AGV) which has the robot arm which moves a module and connects a pipeline by the inter module is prepared apart from a module, a module is moved, and you may make it make it connect with an inhalant canal and an excurrent canal. Drawing 3 is the conceptual diagram of the autonomous type distributed plant drawn by the computer graphics system.
[0035] A module 30 can constitute the pipeline who became independent, respectively by the chamber 32 and the chamber 34, and can convey a flow 1 and a flow 2, and can make the mass transfer between a flow 1 and a flow 2 able to perform, and can make the heat transfer between a flow 1 and a flow 2 perform between a chamber 32 and a chamber 34 further by the above configuration. Mass transfer means distillation and absorption actuation including separation of the matter of mixing of the matter in a flow 1 and a flow 2, a flow 1, and a flow 2. If it puts in another way, a module 30 is a module of the multifunctional mold which achieves a required mass transfer function and/or a heat transfer function according to a situation, for example, can perform an operation of a pipeline, a mixing chamber, a flash drum, an absorber, and a heat exchanger, respectively, further two or more modules 30 gather, and it constitutes an organization autonomously, and can constitute a large-sized single chemistry device. Moreover, modules 30 can gather, and a distilling column can be acted when the module 30 of one another unit operation, for example, a flash drum mode, connects continuously.
[0036] Example 2 this example is an example as which a module demonstrates a heat exchange function, namely, functions as a heat exchanger. Drawing 4 is drawing explaining signs that Module M turns into a seed module (displayed as Seed in drawing 4) according to fluctuation of conditions. the heating area of one module M -- the overall coefficient of heat transfer of 0.3m2 and the heating surface -- 837x103 J/m2hrdegreeC it is . The temperature C of 100 degrees supplied from the utility heat source, and specific heat 0.8J/kgdegreeC The elevated-temperature side flow 1, and the temperature C of 40 degrees and the low temperature side flow 2 of specific heat 0.8J/kgdegreeC flow into Module M. At

condition **, each flow rate of a flow 1 and a flow 2 is the same 100 kg/hr at the beginning. It carries out. Under such conditions, the outlet temperature of a flow 2 is 61.5-degreeC. It becomes. In addition, the conditions of the circumference of Module M are displayed according to the introductory notes shown in drawing 8 . It is a condition number when the above thing is arranged. Item Assignment condition conditions 1 Flow rate of a flow 1 100 kg/hr conditions 2 Flow rate of a flow 2 100 kg/hr conditions 3 Outlet temperature of a flow 2 61.5-degreeC [0037] the flow rate of a flow 2 -- 140kg/hr the time of increasing and becoming condition ** -- the outlet temperature of a flow 2 -- 61.5-degreeC from -- 56.1-degreeC It falls. In this case, the flow rate of the ** flow 2 increases from conditions 2, and Module M detects the boundary condition to which outlet temperature fell from conditions 3. In order to maintain conditions 2 and 3, Module M turns into a seed module and sends the token which carried the information from a function and the original assignment conditions, i.e., a heat exchange function and conditions 1, to conditions 3. This condition is displayed by **. The reflective response to the token of a seed module is a reflective response of Mr. three of serial reflective growth, juxtaposition reflective growth, and serial-parallel reflective growth. Hereafter, it explains one by one.

[0038] Advance of serial reflective growth format serial reflective growth is shown in drawing 5 . A seed module sends a token and S-1 module receives a token. S-1 module which received the token is connected to a serial after a seed module so that it may participate in execution of a heat exchange function. However, by the measurement temperature C [of 60.3 degrees] < temperature [purpose] (C) that of 61.5 degrees which cannot be satisfied only with connection of S-1 module of outlet temperature conditions, S-1 module sends a token, and S-2 module connects a token to a serial after S-1 module so that it may participate in execution of reception and a heat exchange function. Thus, modular serial reflective growth advances, and since it is satisfied with the phase in which S-3 module participated in execution of a heat exchange function of conditions 3 (the measurement temperature C [of 61.7 degrees] > purpose temperature C of 61.5 degrees), modular serial reflective growth stops.

[0039] Advance of juxtaposition reflective growth format juxtaposition reflective growth is shown in drawing 6 . While a seed module sends a token, in order that a seed module may maintain the capacity, it is the flow rate of a flow 1 100 kg/hr It holds. When P-1 module receives the token, a seed module is the remaining flow rates and 40 kg/hr which went back to condition ** at the beginning [the], and flowed into the seed module among the flow rates of the flow 2 in condition **. The flow rate of the flow 1 of conditions 1, and 100kg/hr It flows into P-1 module. Therefore, the full flow of a flow 1 is 200 kg/hr. It becomes. Consequently, the outlet temperature of P-1 module is 81.4-degreeC. It becomes and is the outlet temperature C of 61.5 degrees of a seed module. It is 67.2-degreeC if it mixes with an outflow object. It becomes temperature and conditions 3 are satisfied. Therefore, conditions 2 and 3 are canceled and modular juxtaposition reflective growth stops here.

[0040] Advance of serial-parallel reflective growth format serial-parallel reflective growth is shown in drawing 7 . A seed module sends two tokens and S-1 module of the neighborhood of a seed module and P-1 module receive a token. Since the means of communications which forbids much reflective responses is not specified between S-1 module and P-1 module, transfer of an above-mentioned token is performed under an irregular reflective response mechanism. The service condition of S-1 module is a service condition when S-1 module connects with the seed module in juxtaposition reflective growth at a serial, and the service condition of P-1 module of it is the same as that of the service condition of P-1 module in juxtaposition growth. The outlet temperature of S-1 module is 65.7-degreeC. The temperature since it becomes, after mixing the flow 2 which flowed out of S-1 module and P-1 module, respectively is 70.2-degreeC. It becomes and conditions 3 are satisfied. Thus, conditions 2 and conditions 3 are canceled. After reflective growth, a seed module returns to the original condition **, and will be in the same condition as the case of juxtaposition reflective growth, and conditions 2 and conditions 3 are canceled, without needing the heat exchange function of S-1 module. Consequently, S-1 module turns into an additional module. When putting in another way and it detects that entry conditions agree on the conditions carried by the token, S-1 module changes the function of itself into a pipeline.

[0041] In this example, in order to cancel deviation from assignment conditions on an outlet boundary, Mr. three's growth format mentioned above is made autonomously. Since a system is individually

discontinuous and it grows up, solutions agree [all] in the constraint on all quality, and it cannot be satisfied. for example, the outlet temperature of each above-mentioned solution -- 61.7-degreeC and 67.2-degreeC And 70.2-degreeC it is -- the beginning -- the outlet temperature of conditions, and 61.5-degreeC It is not equal. It is required to take the relation of a trade-off into consideration between the number of modular and the consumption of a utility economically, when choosing serial growth or juxtaposition growth. From a viewpoint on operation, serial-parallel growth has the greatest margin. Therefore, it is difficult whether the growth format which can creep locally and statically is the best system, and to decide.

[0042] Example 3 example 3 is an example explaining the design concept of an autonomous type distributed plant. First, the design technique of the conventional unit operation is used and a fundamental process flow as shown in drawing 9 (a) is specified based on a predetermined raw material, the specification of a product, and a service condition. This process flow 80 is equipped with a heat exchanger 82, a flash drum 84, the distilling column 86, the condenser 88, the reservoir tub 90, and the reboiler 92. In this process flow 80, after carrying out the temperature up of the raw material by the heat exchanger 82, a flash plate is carried out with a flash drum 84, it separates into an overhead gas-like component and a liquid-like bottom component, and both sides are supplied to a distilling column 86. In a distilling column 86, after making an overhead fraction condense with a condenser 88, it receives in the reservoir tub 90, the part is flowed back to a distilling column 86, and the remainder is sent out out of a system. In the bottom of a distilling column 86, a part of bottom fraction is made to evaporate with a reboiler 92, and the raw material which cooperated with the reflux operation and was supplied is distilled.

[0043] It can decompose, as shown in drawing 9 (b) as a set of the micro chemical process module (it is hereafter called a module for short) of the lot equipped with the same configuration as the module 30 with which connection **** each piping shows each device for the unit operation of above-mentioned heat exchanger 82 grade, and it to an example 1, respectively. in drawing 9 (b), each module is arranged at the two-dimensional flat surface on which each one measure eye was drawn with the scale mark of the shape of a grid of the same magnitude as one module.

[0044] When the flow rate of a raw material increases from the predetermined flow rate at the time of a design after gathering the module as mentioned above and arranging, according to the growth format explained in the example 2, as shown in drawing 9 (c), it increases, the surrounding neighboring module of a seed module cancels a limit, acts autonomously and reconstructs an organization so that assignment conditions may be satisfied. Thereby, an autonomous type distributed plant can acquire the capacity to answer change of all external conditions, among those to build a section-system structure autonomously, without needing an integrated control system.

[0045]

[Effect of the Invention] According to invention of claim 1, the micro chemical process module which is the multifunctional mold which achieves a required mass transfer function and/or a heat transfer function according to a situation, and can be gathered and increased autonomously is realized by having a hold means, an inflow means, an outflow means, a flow control unit, and a transponder style equally to each module. When micro chemical process modules increase and gather autonomously and are enlarged, the unit device for chemical processes which can process required throughput under the situation of arbitration as predetermined is realized. According to invention of claims 5 and 6, by constituting the module aggregate which gathered the micro chemical process module, it is the high process plant of the flexibility which can follow in footsteps of social economical fluctuation, and, moreover, the high plant of economical efficiency and the autonomous type distributed plant which can always be operated with maximum efficiency under the conditions of the arbitration given then instead of the bottom of a design condition when putting in another way are realized. Therefore, the autonomous type distributed plant concerning this invention is the optimal as a production plant in the case of changing the description of a raw material and a product, and also changing a throughput.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] This invention relates to the autonomous type distributed process plant formed with the aggregate of a micro chemical process module and a micro chemical process module.

[Translation done.]

PRIOR ART

[Description of the Prior Art] On these specifications, process plants are the liquid with which the object to deal with can mainly form a fluid, and/or a gas (a powdery part and a granule are included), and machining is a plant which performs chemical processing which is the opposing concept. Therefore, a process plant says the plant used in a large field including the chemical industry, pulp industry, a cement industry, etc. By the way, also ontically supposing one process flow, based on the process flow, the conventional process plant (simply henceforth a plant) made the unit operation (unit operation) for heat transfer and mass transfer perform, for example, is notional materialized as a combination of single chemistry devices, such as a heat exchanger, a distilling column, and a vapor-liquid-separation tub.
[0003] If in charge of the design of a plant, and construction, operation flexibility (versatility and versatility when operating a plant) required in order to operate a plant economically according to the optimization design on a process and economy and social economical fluctuation, and high cost competitiveness have been made into the important design objective of a plant. So, by the design technique of the conventional plant, optimization of a single chemistry device has been attained noting that the whole plant which combined them can also be optimized in process and economically, if each of the single chemistry device which constitutes a plant is optimized in process and economically. In order to enlarge operation flexibility of a plant, many case studies which changed the specification of a throughput, a product, and a raw material were performed, the so-called design margin was determined from the result, and the specification of each optimized device has been seasoned with the design margin. Moreover, in order to acquire high cost competitiveness, the plant has been enlarged in quest of economies of scale.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to invention of claim 1, the micro chemical process module which is the multifunctional mold which achieves a required mass transfer function and/or a heat transfer function according to a situation, and can be gathered and increased autonomously is realized by having a hold means, an inflow means, an outflow means, a flow control unit, and a transponder style equally to each module. When micro chemical process modules increase and gather autonomously and are enlarged, the unit device for chemical processes which can process required throughput under the situation of arbitration as predetermined is realized. According to invention of claims 5 and 6, by constituting the module aggregate which gathered the micro chemical process module, it is the high process plant of the flexibility which can follow in footsteps of social economical fluctuation, and, moreover, the high plant of economical efficiency and the autonomous type distributed plant which can always be operated with maximum efficiency under the conditions of the arbitration given then instead of the bottom of a design condition when putting in another way are realized. Therefore, the autonomous type distributed plant concerning this invention is the optimal as a production plant in the case of changing the description of a raw material and a product, and also changing a throughput.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, based on a process flow, the single chemistry device which performs required unit operation is adopted, each single chemistry device is optimized, and the following problems are included in the plant constituted according to the conventional plant construct referred to as constituting one plant combining them. Although the plant was enlarged as a result of having pursued economical efficiency, in the 1st, it is a low throughput from the relation between need and supply actually, and is the large-sized plant's being operated by the low throughput beyond the schedule limitation at the time of a design in many cases, and saying moreover. Now, there is no semantics which enlarged the plant and searched for economical efficiency. Generally that is because a plant is interlocked with a consecutive plant and operated. For example, a throughput is decided only on account of the plant, by the throughput, a plant cannot be operated or operation of a plant cannot be conversely suspended only on account of the plant. Especially this constraint is remarkable when forming industrial complex.
[0005] This technique is also ineffective when a service condition must be changed across the limitation of that design margin, even if it has seasoned each single chemistry device with the design margin in consideration of fluctuation of the service condition of a plant, respectively. For example, when the throughput at the time of operation is 50% of a design throughput, it is said that the operating cost requires o'clock of costs 70% of a design throughput. As mentioned above, even if each single chemistry device is based on the unit operation defined at the time of a plant engineering design and is designed and manufactured by the optimal dimension and the specification, in the time of operation, it stops being already the optimal design therefore, and the plant has lost cost competitiveness.
[0006] Since the function of each single chemistry device is being fixed, functions cannot be mutually exchanged among single chemistry devices, or sequence of unit operation cannot be changed into the 2nd. For example, it cannot perform actually using a vapor-liquid-separation tub as a heat exchanger. Therefore, since the configuration of a plant is being fixed, it is difficult to change free, the sequence, i.e., the process flow, of processing. If it puts in another way, extent of operation flexibility is restricted by the fixed process flow and the independence of each single chemistry device. Now, it means that it cannot follow in footsteps of the situation of current [which a raw material and a product are diversifying increasingly], and its diversification.
[0007] It is the problem of the operation control of a plant the 3rd. Even if fluctuation of a service condition was in the limitation of a design margin, in order to operate a plant under the changed service condition, it is required to determine a certain service condition and the optimal desirable service condition to all the single devices that constitute a plant. For that purpose, it is required to build the control system which is equipped with a process computer, performs complicated process calculation, and supervises the whole process based on the result of process calculation, and can be controlled. However, even if a process computer develops remarkably, an entire plant is supervised, the control system to control needs the control program with which it is based, and the control program must be developed and maintained by the process engineer, plug Lamaism's individual capacity, and collaboration. Therefore, the thing which constitute a plant and for which the optimal service condition

is computed for every device, and each device is controlled by the condition is a thing difficult so in fact that you may say that implementation is impossible, if mediation of human being who has the capacity which can control such a wide range variable is needed at all. Now, the semantics which gives a design margin is lost in a plant engineering design.

[0008] As mentioned above, as explained, by [which constitute a process flow] optimizing allocation and its device for a single chemistry device for every unit operation, high flexibility and high economical efficiency can serve as a demand of an antinomy mutually, and coincidence cannot be made satisfied with the conventional technique of optimizing an entire plant of both sides. Therefore, it is becoming clear to say that the plant where the conventional technique combines high flexibility and high economical efficiency, i.e., the plant with which can be satisfied of various demands accompanying social rapid economical development, cannot be offered. And when preserving a good environment, and when considering the environmental problem and energy problems which accompany a plant attaining reduction-ization of the energy used, it is the process thing [economical optimization] of a plant very.

[0009] It is offering the new process plant which combines the high flexibility to which the purpose of this invention can follow in footsteps of social economical fluctuation in the light of the above situation, and high operation effectiveness.

[Translation done.]

* NOTICES *

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MEANS

[Means for Solving the Problem] this invention person etc. thinks that the new plant where a concept differs from the conventional plant is required in order to attain the above-mentioned purpose, devises the micro chemical process module of the multifunctional mold which can demonstrate a required function according to a situation, and came to complete this invention paying attention to the ability to be able to constitute a plant by gathering it by making this micro chemical process module into a configuration unit.
[0011] In order to attain the above-mentioned purpose, based on this knowledge, the micro chemical process module concerning this invention Receive and hold a fluid, and pay out, and when few, the hold means of two things, An inflow means to make a fluid flow into each hold means from the outside of a system, and an outflow means to make a fluid flow out of each hold means out of a system, The flow control unit which has a transportation function, a closing motion function, and sensor ability, and was formed in the inflow means and the outflow means, respectively, It consists of transponder styles which answer from the outside of a system to the coming target token, collaborate with a flow control unit, and act autonomously. The heat transfer actuation between the fluids received in the hold means, the mass transfer operation between the fluids received in the hold means, It is characterized by performing at least one actuation in the splitting actuation between the hold means of the flowing fluid, and unification actuation of the fluid which flows out of a hold means between two hold means through an inflow means and an outflow means from the outside of a system.
[0012] On these specifications, it can come from the outside of a system with the information about a function and conditions, the information can be inputted into a micro chemical process module, and, as for a target token, the micro chemical process module which obtained the target token can acquire a participating right to predetermined actuation. Moreover, it says acting by the own norm of a micro chemical process module or criteria, without basing that it is autonomous on directions of human being. In this invention, a hold means is a container, an inflow means and an outflow means are pipes, a transportation function is a micropump, a closing motion function is a closing motion valve, and sensor ability is sensors, such as a thermometer and a pressure gage.
[0013] Two hold means the suitable embodiment of this invention at one edge, respectively the 1st and 2nd input It is formed in the other-end section countered and located in one edge by the pair of the 1st and 2nd chambers which has the 1st and 2nd tap holes. The 1st and 2nd tees by which the inflow means was formed in the 1st and 2nd inhalant canals which come from the outside free [connection and discharge], respectively, The 1st and 2nd inlet pipes which connect the 1st tee, the 1st input of the 1st chamber, and the 2nd tee and the 1st input of the 2nd chamber, respectively, It is formed with the 1st and the 2nd minute flow tube which connect the 1st tee, the 2nd input of the 2nd chamber, and the 2nd tee and the 2nd input of the 1st chamber, respectively. The 1st and 2nd unification section by which the outflow means was formed in the 1st and 2nd excurrent canals which come out outside free [connection and discharge], respectively, The 1st and 2nd outlet pipes which connect the 1st tap hole and the 1st unification section of the 1st chamber, and the 1st tap hole and the 2nd unification section of the 2nd chamber, respectively, It is formed by the 1st and 2nd pipe with collectors which connect the 2nd tap

hole and the 2nd unification section of the 1st chamber, and the 2nd tap hole and the 1st unification section of the 2nd chamber, respectively. furthermore, between the 1st tee and the 1st unification section and between the 2nd tee and the 2nd unification section The 1st by-path pipe and the 2nd by-path pipe are connected. The 1st and 2nd inlet pipes, The flow control unit formed in the 1st and the 2nd minute flow tube, the 1st and 2nd outlet pipes, and the 1st and 2nd pipe-with-collector list at each of the 1st and 2nd by-path pipes A closing motion means to open and close the transportation means of flowing fluid, and tubing for the inside of tubing, respectively, A sensor means to detect description for the inside of tubing in the temperature and the pressure list of flowing fluid, It has the control means which controls a transportation means and a closing motion means, a transponder style calculates and judges based on the information on a target token, and the detection data of a sensor means, a command is taken out to a control means, and it is characterized by having a means to send a target token out of a system further.
[0014] The still more suitable embodiment of this invention is characterized by a control means outputting either command of an ON state and an OFF state to a transportation means and a closing motion means. It says that an ON state is in operating state here, for example, a transportation means is in the condition that a fluid can be conveyed, and a closing motion means is in an open condition, it says that a sensor means is in a detectable condition, and an OFF state means that it is in the condition that each is contrary to an ON state.
[0015] A transponder style directs the attitude destination and path of a micro chemical process module to an automatic guide wheel, and is conveyed by the automatic guide wheel according to a command, and the still more suitable embodiment of this invention is characterized [the 1st and 2nd tees] for the 1st and 2nd unification section by connection or carrying out connection release at the 1st and 2nd excurrent canals at the 1st and 2nd inhalant canals, respectively.
[0016] Moreover, two or more micro chemical process modules given in any 1 term of the claims 1-4 gather autonomously and in each, connect the autonomous type distributed plant concerning this invention mutually, it forms a module aggregate, and the module aggregate is being [made to perform predetermined unit operation / it] characterized by it. Unit operation means the single actuation accompanied by heat transfer and mass transfer, for example, means the actuation on processes, such as heat exchange, splitting, unification, absorption, mixing, and vapor liquid separation.
[0017] Furthermore, another autonomous type distributed plant concerning this invention Two or more micro chemical process modules of a publication gather autonomously and in each in any 1 term of the claims 1-4. Consist of two or more module aggregates which it comes to connect mutually, and each module aggregate performs unit operation based on a predetermined process flow, respectively. It is characterized by performing a series of processing based on a predetermined process flow by it.

[Translation done.]

* NOTICES *

OPERATION

[Function] In invention according to claim 1, it has a hold means, an inflow means, an outflow means, a flow control unit, and a transponder style, and acts in independent and autonomously, and the configuration unit as a single chemistry device which can perform at least one process actuation is formed.
[0019] When two or more micro chemical process modules gather independently autonomously and in each, connect mutually, and form the aggregate and the aggregate performs predetermined unit operation, respectively, an autonomous type distributed plant consists of invention given in claims 5 and 6.

[Translation done.]

EXAMPLE

[Example] Hereafter, with reference to an accompanying drawing, this invention is explained more to a detail based on an example.
Example 1 drawing 1 is drawing showing the configuration of the example 1 of the micro chemical process module concerning this invention. The micro chemical process module (it is hereafter called a module for short simply) 30 of this example is the box of the rectangle of the same structure, and is mutually equipped with a pair of 1st chamber 32 and 2nd chamber 34 which are carrying out field contact in fields. The 1st chamber 32 equips with the 1st tap hole 40 and the 2nd tap hole 42 the outlet edge which counters an inlet-port edge and is located in an inlet-port edge in the 1st input 36 and the 2nd input 38. The 2nd chamber 34 is similarly equipped with the 3rd input 44, the 4th input 46, the 3rd tap hole 48, and the 4th tap hole 50.
[0021] The 1st inhalant canal 52 and the 2nd inhalant canal 54 into which the fluid of a flow 1 and the fluid of a flow 2 are made to flow, respectively carried out Iriki to the module 30 from the outside, and the 1st tee 56 and the 2nd tee 58 have connected with the 1st inhalant canal 52 and the 2nd inhalant canal 54 free [discharge], respectively. Moreover, from the module 30, the 1st excurrent canal 60 and the 2nd excurrent canal 62 have come out outside, and the 1st unification section 64 and the 2nd unification section 66 have connected with the 1st excurrent canal 60 and the 2nd excurrent canal 62 free [discharge].
[0022] The 1st inlet pipe 2 and the 1st minute flow tube 3 reached the 1st tee 56 and the 1st input 36 of the 1st chamber 32, and have connected the 1st tee 56 and the 4th input 46 of the 2nd chamber 34, respectively. Similarly, the 2nd inlet pipe 7 and the 2nd minute flow tube 8 reached the 2nd tee 58 and the 3rd input 44 of the 2nd chamber 34, and have connected the 2nd tee 58 and the 2nd input 38 of the 1st chamber 32, respectively. Furthermore, the 1st outlet pipe 4 and the 1st pipe with collector 5 have connected the 1st tap hole 40 and the 1st unification section 64 of the 1st chamber 32, and the 4th tap hole 50 and the 1st unification section 64 of the 2nd chamber 34, respectively. Similarly, the 2nd outlet pipe 9 and the 2nd pipe with collector 10 have connected the 3rd tap hole 48 and the 2nd unification section 66 of the 2nd chamber 34, and the 2nd tap hole 42 and the 2nd unification section 66 of the 1st chamber 32, respectively. Moreover, the 1st by-path pipe 1 and the 2nd by-path pipe 6 connect the 1st tee 56, the 1st unification section 64, and the 2nd tee 58 and the 2nd unification section 66, and are bypassing the 1st chamber 32 and the 2nd chamber 34, respectively.
[0023] To each of the 1st and 2nd inlet pipes 2 and 7, the 1st and the 2nd minute flow tubes 3 and 8, the 1st and 2nd outlet pipes 4 and 9, the 1st and 2nd pipe with collectors 5 and 10, the 1st by-path pipe 1, and the 2nd by-path pipe 6 A transportation means (for example, pump) to convey a fluid, respectively, and a closing motion means to open and close tubing (for example, closing motion valve), The flow control unit (it is hereafter written as FCU) which consists of a set with a detection means (for example, sensor) to detect description for the inside of tubing in the temperature and the pressure list of flowing fluid, and the control means which controls a transportation means and a closing motion means is formed. Each means, such as a transportation means, supplies energy independently with a solar battery, a fuel cell, etc., and operates, respectively. At drawing 1 , the flow control unit formed in the 1st by-path

pipe 1 is displayed by **. The same is said of the flow control unit hereafter formed in each tubing.
[0024] Furthermore, a pair of chambers 32 and 34 were equipped with the microcomputer which it is inputted from each means and outputted to each means, they were calculated based on the detection data of a detection means, answered to the token which comes from the outside of a system, and are equipped with the transponder style 68 which sends a token out of a system further. The program is inputted beforehand and a microcomputer performs operation actuation, decision actuation, dispatch actuation of a command, etc. based on it. In addition, at this example, the transponder style 68 does not make a complicated judgment only by [each] collaborating with FCU, making a binary judgment on the below-mentioned token in conditioned reflex, and performing a binary response. here -- a conditioned reflex --- like -- answering (reflective response) -- it is answering in conditioned reflex by binary condition, such as an ON state or an OFF state, **, or nothing, without thinking of [complicated logic]. Moreover, a control means outputs either command of an ON state and an OFF state to a transportation means and a closing motion means in response to a command from the transponder style 68. In drawing 1 , the connection with each means from an erection mechanism 68 is displayed typically.
[0025] Although the module 30 constituted as mentioned above may be formed with the dimension of arbitration, it is general to gather a module 30 and to be miniature-ized from one single chemistry device and the concept referred to as to constitute a plant further.
[0026] The format of a reflective response has the internal reflective response produced within a module 30, and the external reflective response sent out of a system from a module 30, an example 1 is made into an example and each typical reflective response is listed to below.
It is specified that the internal reflective response 1 internal reflective response 1 is a reflective response of the outlet FCU to an inlet port FCU, and is eliminating lock out of the flowing flow. Therefore, there is the following combination of the inlet port FCU of an ON state and the outlet FCU of an ON state. An ON state means that it is in operating state, for example, the pump of FCU has it in operational status, a closing motion valve has it in an open condition, it means that a sensor is in a detectable condition, and, as for an OFF state, a pump, a closing motion valve, and a sensor mean that it is in a condition contrary to an ON state, respectively.
Inlet port FCU of an ON state Outlet FCU of an ON state 2 and/or 8 4 and/or 10 3 and/or 7 5 and/or 9
[0027] It is specified that the internal reflective response 2 internal reflective response 2 is an exclusive reflective response of an inlet port FCU and Outlet FCU, and is not separating the flowing flow and not mixing two outflow flows. Therefore, there is the following combination of the OFF/ON state corresponding to FCU of ON/OFF state, and FCU.
FCU of ON/OFF state FCU of OFF/ON state 2 3 4 5 7 8 9 10 [0028] The external reflective response 1 external reflective response 1 is a reflective response to a neighboring module, and judges whether each module can maintain the constraint on the operation by detecting the outlet condition. When a certain module has recognized that the constraint on operation is over the capacity, the module is announced by the token which mentions deviation of conditions later to a neighboring module. Thereby, a series of advance of a reflective response, i.e., propagation of a reflective response, is caused by the neighboring inter module. There are following two assignment conditions, i.e., quantitative conditions, and qualitative conditions in causing a reflective response independently, and there is propagation of a reflective response which corresponds to it. The example of the conditions from which it deviated is an example of the quantitative conditions from which it deviated, and qualitative conditions. If a seed module detects both conditions to coincidence, it will cause in [the growth format of Mr. three of a serial, juxtaposition, and serial-parallel growth / one] irregular.
Assignment conditions Propagation of a reflective response Example of the conditions from which it deviated Quantitative conditions Juxtaposition propagation Flow rate Qualitative conditions Serial propagation Temperature, presentation [0029] It is specified that the external reflective response 2 external reflective response 2 is a reflective response about a module function, and is that the function of the increased module carries out the double counterpart of the function of the module which hands over a reflective response. Although a modular function is a pipeline's 1 function shown in Table 1 mentioned later when it is set as a module before the first reflective response (i.e., at the beginning), it

metamorphoses into the demanded function by this external reflective response 2.
[0030] The external reflective response 3 external reflective response 3 is a reflective response about a common resource, and it is specified that each modular outlet flow and a modular utility are a common resource. The 1st module can obtain all required resources.
[0031] Table 1 shows the functional chart of the module based on two kinds of above-mentioned internal reflective responses of a format.
[Table 1]

モジュール機能	フロー制御ユニット番号									
	フロー1					フロー2				
	1	2	3	4	5	6	7	8	9	10
パイプライン1	オン									
パイプライン2						オン				
パイプライン3	オン					オン				
パイプライン4		オン		オン						
パイプライン5		オン								オン
パイプライン6			オン		オン					
パイプライン7			オン						オン	
パイプライン8					オン		オン			
パイプライン9							オン		オン	
パイプライン10				オン				オン		
パイプライン11								オン		オン
混合器1		オン		オン				オン		
混合器2		オン						オン		オン
混合器3			オン		オン		オン			
混合器4			オン				オン		オン	
熱交換器1		オン		オン			オン		オン	
熱交換器2		オン			オン		オン			オン
熱交換器3			オン	オン				オン	オン	
熱交換器4			オン		オン			オン		オン
フラッシュ・ドラム1		オン		オン						オン
フラッシュ・ドラム2			オン		オン				オン	
フラッシュ・ドラム3					オン		オン		オン	
フラッシュ・ドラム4				オン				オン		オン
吸収器1		オン		オン				オン		オン
吸収器2			オン		オン		オン		オン	

The module 30 shown in Table 1 has the function of heat transfer, mass transfer, separation, and mixing. combining FCU according to Table 1 -- one module 30 to 11 kinds of voice -- a pipeline [like] and four kinds of voice -- a mixer [like], four kinds of heat exchangers, four kinds of flash drums, and two kinds of absorbers are formed. The usual distilling column is easily realizable using two or more modules which have a flash drum function.
[0032] Drawing 2 shows typically the serial of a reflective response and juxtaposition growth to the seed module which detected the constraint in a boundary. In this reflective response, a target token (it is hereafter called a token for short simply) spreads as a communication protocol. The token carries the information about the module function and the assignment conditions of having been sent with the seed module. When a module receives a token, a module carries out the double counterpart of the function

and conditions as the information carried by the token. When satisfied [with the module which all the conditions increased], it stops and propagation of a reflective response ends a token. Such propagation and a halt of the external reflective response by the inter module form an autonomous organization configuration device, and build a system structure without the integrated control system which needs people's mediation autonomously. The module which obtained the target token seems in addition, to acquire a participating right with the information concerning [a target token] a function and conditions on these specifications by information and communication fields, although the communication device with which the token captured the token is used in the semantics referred to as acquiring a transmission right. A reflective response means answering in conditioned reflex, without requiring complicated decision.

[0033] Even if capacity is small and it cannot satisfy the demand on the process given only by the single module since effectiveness was low, the demand on a process can be satisfied by collecting the modules of a large herd according to a growth device. Since a modular large majority is operated at the highest effectiveness in the bottom of a growth device, an autonomous type distributed plant can always be operated with high overall efficiency from the conventional-type plant which is not operated under optimum conditions.

[0034] A module is equipped with the jet injection type driving gear which makes a self-supporting driving gear, for example, a solar battery, the source of power, and you may enable it to move it. Moreover, the automatic guidance car (Automatic Guided Vehicle, AGV) which has the robot arm which moves a module and connects a pipeline by the inter module is prepared apart from a module, a module is moved, and you may make it make it connect with an inhalant canal and an excurrent canal. Drawing 3 is the conceptual diagram of the autonomous type distributed plant drawn by the computer graphics system.

[0035] A module 30 can constitute the pipeline who became independent, respectively by the chamber 32 and the chamber 34, and can convey a flow 1 and a flow 2, and can make the mass transfer between a flow 1 and a flow 2 able to perform, and can make the heat transfer between a flow 1 and a flow 2 perform between a chamber 32 and a chamber 34 further by the above configuration. Mass transfer means distillation and absorption actuation including separation of the matter of mixing of the matter in a flow 1 and a flow 2, a flow 1, and a flow 2. If it puts in another way, a module 30 is a module of the multifunctional mold which achieves a required mass transfer function and/or a heat transfer function according to a situation, for example, can perform an operation of a pipeline, a mixing chamber, a flash drum, an absorber, and a heat exchanger, respectively, further two or more modules 30 gather, and it constitutes an organization autonomously, and can constitute a large-sized single chemistry device. Moreover, modules 30 can gather, and a distilling column can be acted when the module 30 of one another unit operation, for example, a flash drum mode, connects continuously.

[0036] Example 2 this example is an example as which a module demonstrates a heat exchange function, namely, functions as a heat exchanger. Drawing 4 is drawing explaining signs that Module M turns into a seed module (displayed as Seed in drawing 4) according to fluctuation of conditions. the heating area of one module M -- the overall coefficient of heat transfer of 0.3m2 and the heating surface -- 837x103 J/m2hrdegreeC it is . The temperature C of 100 degrees supplied from the utility heat source, and specific heat 0.8J/kgdegreeC The elevated-temperature side flow 1, and the temperature C of 40 degrees and the low temperature side flow 2 of specific heat 0.8J/kgdegreeC flow into Module M. At condition **, each flow rate of a flow 1 and a flow 2 is the same 100 kg/hr at the beginning. It carries out. Under such conditions, the outlet temperature of a flow 2 is 61.5-degreeC. It becomes. In addition, the conditions of the circumference of Module M are displayed according to the introductory notes shown in drawing 8 . It is a condition number when the above thing is arranged. Item Assignment condition conditions 1 Flow rate of a flow 1 100 kg/hr conditions 2 Flow rate of a flow 2 100 kg/hr conditions 3 Outlet temperature of a flow 2 61.5-degreeC [0037] the flow rate of a flow 2 -- 140kg/hr the time of increasing and becoming condition ** -- the outlet temperature of a flow 2 -- 61.5-degreeC from -- 56.1-degreeC It falls. In this case, the flow rate of the ** flow 2 increases from conditions 2, and Module M detects the boundary condition to which outlet temperature fell from conditions 3. In order to

maintain conditions 2 and 3, Module M turns into a seed module and sends the token which carried the information from a function and the original assignment conditions, i.e., a heat exchange function and conditions 1, to conditions 3. This condition is displayed by **. The reflective response to the token of a seed module is a reflective response of Mr. three of serial reflective growth, juxtaposition reflective growth, and serial-parallel reflective growth. Hereafter, it explains one by one.
[0038] Advance of serial reflective growth format serial reflective growth is shown in drawing 5 . A seed module sends a token and S-1 module receives a token. S-1 module which received the token is connected to a serial after a seed module so that it may participate in execution of a heat exchange function. However, by the measurement temperature C [of 60.3 degrees] < temperature [purpose] (C) that of 61.5 degrees which cannot be satisfied only with connection of S-1 module of outlet temperature conditions, S-1 module sends a token, and S-2 module connects a token to a serial after S-1 module so that it may participate in execution of reception and a heat exchange function. Thus, modular serial reflective growth advances, and since it is satisfied with the phase in which S-3 module participated in execution of a heat exchange function of conditions 3 (the measurement temperature C [of 61.7 degrees] > purpose temperature C of 61.5 degrees), modular serial reflective growth stops.
[0039] Advance of juxtaposition reflective growth format juxtaposition reflective growth is shown in drawing 6 . While a seed module sends a token, in order that a seed module may maintain the capacity, it is the flow rate of a flow 1 100 kg/hr It holds. When P-1 module receives the token, a seed module is the remaining flow rates and 40 kg/hr which went back to condition ** at the beginning [the], and flowed into the seed module among the flow rates of the flow 2 in condition **. The flow rate of the flow 1 of conditions 1, and 100kg/hr It flows into P-1 module. Therefore, the full flow of a flow 1 is 200 kg/hr. It becomes. Consequently, the outlet temperature of P-1 module is 81.4-degreeC. It becomes and is the outlet temperature C of 61.5 degrees of a seed module. It is 67.2-degreeC if it mixes with an outflow object. It becomes temperature and conditions 3 are satisfied. Therefore, conditions 2 and 3 are canceled and modular juxtaposition reflective growth stops here.
[0040] Advance of serial-parallel reflective growth format serial-parallel reflective growth is shown in drawing 7 . A seed module sends two tokens and S-1 module of the neighborhood of a seed module and P-1 module receive a token. Since the means of communications which forbids much reflective responses is not specified between S-1 module and P-1 module, transfer of an above-mentioned token is performed under an irregular reflective response mechanism. The service condition of S-1 module is a service condition when S-1 module connects with the seed module in juxtaposition reflective growth at a serial, and the service condition of P-1 module of it is the same as that of the service condition of P-1 module in juxtaposition growth. The outlet temperature of S-1 module is 65.7-degreeC. The temperature since it becomes, after mixing the flow 2 which flowed out of S-1 module and P-1 module, respectively is 70.2-degreeC. It becomes and conditions 3 are satisfied. Thus, conditions 2 and conditions 3 are canceled. After reflective growth, a seed module returns to the original condition **, and will be in the same condition as the case of juxtaposition reflective growth, and conditions 2 and conditions 3 are canceled, without needing the heat exchange function of S-1 module. Consequently, S-1 module turns into an additional module. When putting in another way and it detects that entry conditions agree on the conditions carried by the token, S-1 module changes the function of itself into a pipeline.
[0041] In this example, in order to cancel deviation from assignment conditions on an outlet boundary, Mr. three's growth format mentioned above is made autonomously. Since a system is individually discontinuous and it grows up, solutions agree [all] in the constraint on all quality, and it cannot be satisfied. for example, the outlet temperature of each above-mentioned solution -- 61.7-degreeC and 67.2-degreeC And 70.2-degreeC it is -- the beginning -- the outlet temperature of conditions, and 61.5-degreeC It is not equal. It is required to take the relation of a trade-off into consideration between the number of modular and the consumption of a utility economically, when choosing serial growth or juxtaposition growth. From a viewpoint on operation, serial-parallel growth has the greatest margin. Therefore, it is difficult whether the growth format which can creep locally and statically is the best system, and to decide.
[0042] Example 3 example 3 is an example explaining the design concept of an autonomous type

distributed plant. First, the design technique of the conventional unit operation is used and a fundamental process flow as shown in drawing 9 (a) is specified based on a predetermined raw material, the specification of a product, and a service condition. This process flow 80 is equipped with a heat exchanger 82, a flash drum 84, the distilling column 86, the condenser 88, the reservoir tub 90, and the reboiler 92. In this process flow 80, after carrying out the temperature up of the raw material by the heat exchanger 82, a flash plate is carried out with a flash drum 84, it separates into an overhead gas-like component and a liquid-like bottom component, and both sides are supplied to a distilling column 86. In a distilling column 86, after making an overhead fraction condense with a condenser 88, it receives in the reservoir tub 90, the part is flowed back to a distilling column 86, and the remainder is sent out out of a system. In the bottom of a distilling column 86, a part of bottom fraction is made to evaporate with a reboiler 92, and the raw material which cooperated with the reflux operation and was supplied is distilled.

[0043] It can decompose, as shown in drawing 9 (b) as a set of the micro chemical process module (it is hereafter called a module for short) of the lot equipped with the same configuration as the module 30 with which connection **** each piping shows each device for the unit operation of above-mentioned heat exchanger 82 grade, and it to an example 1, respectively. in drawing 9 (b), each module is arranged at the two-dimensional flat surface on which each one measure eye was drawn with the scale mark of the shape of a grid of the same magnitude as one module.

[0044] When the flow rate of a raw material increases from the predetermined flow rate at the time of a design after gathering the module as mentioned above and arranging, according to the growth format explained in the example 2, as shown in drawing 9 (c), it increases, the surrounding neighboring module of a seed module cancels a limit, acts autonomously and reconstructs an organization so that assignment conditions may be satisfied. Thereby, an autonomous type distributed plant can acquire the capacity to answer change of all external conditions, among those to build a section-system structure autonomously, without needing an integrated control system.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the configuration of the example 1 of the micro chemical process module concerning this invention.
[Drawing 2] The serial of a reflective response and juxtaposition growth to the seed module which detected the limitation are shown typically.
[Drawing 3] It is the conceptual diagram of the autonomous type distributed plant drawn by the computer graphics system.
[Drawing 4] It is drawing explaining signs that Module M turns into a seed module according to fluctuation of conditions.
[Drawing 5] It is drawing showing advance of serial reflective growth.
[Drawing 6] It is drawing showing advance of juxtaposition reflective growth.
[Drawing 7] It is drawing showing advance of serial-parallel reflective growth.
[Drawing 8] It is drawing having shown the introductory notes about drawing 8 from drawing 4 .
[Drawing 9] Drawing 9 (a), (b), and (c) are drawings explaining the design concept of an autonomous type distributed plant, respectively.
[Description of Notations]
1 1st By-path Pipe
2 1st Inlet Pipe
3 1st Minute Flow Tube
4 1st Outlet Pipe
5 1st Pipe with Collector
6 2nd By-path Pipe
7 2nd Inlet Pipe
8 2nd Minute Flow Tube
9 2nd Outlet Pipe
10 2nd Pipe with Collector
30 Micro Chemical Process Module
32 1st Chamber
34 2nd Chamber
36 1st Input
38 2nd Input
40 1st Tap Hole
42 2nd Tap Hole
44 3rd Input
46 4th Input
48 3rd Tap Hole
50 4th Tap Hole
52 1st Inhalant Canal

54 2nd Inhalant Canal
56 1st Tee
58 2nd Tee
60 1st Excurrent Canal
62 2nd Excurrent Canal
64 1st Unification Section
66 2nd Unification Section
80 An Example of Process Flow
82 Heat Exchanger
84 Flash Drum
86 Distilling Column
88 Condenser
90 Reservoir Tub
92 Reboiler

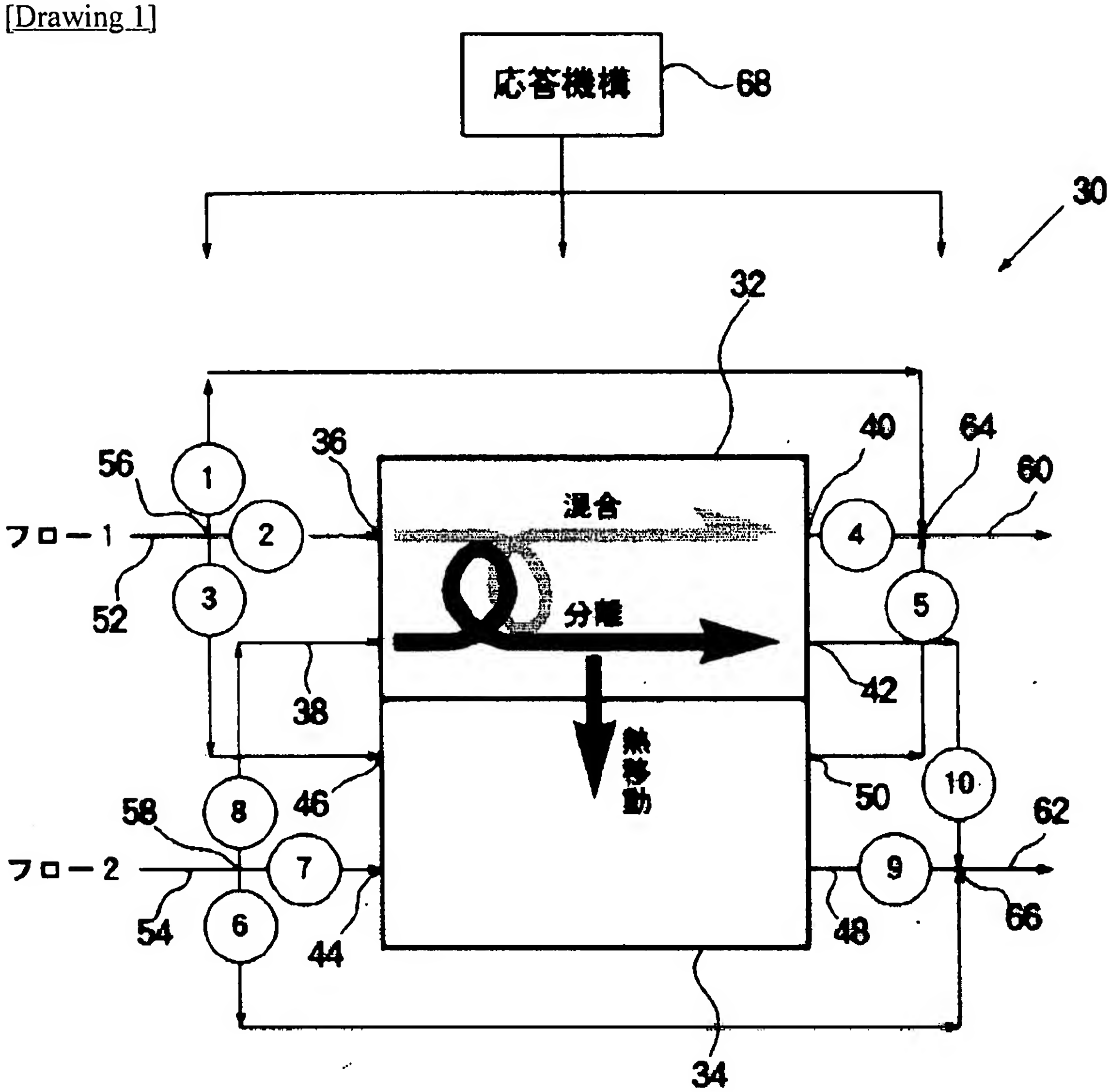
[Translation done.]

* NOTICES *

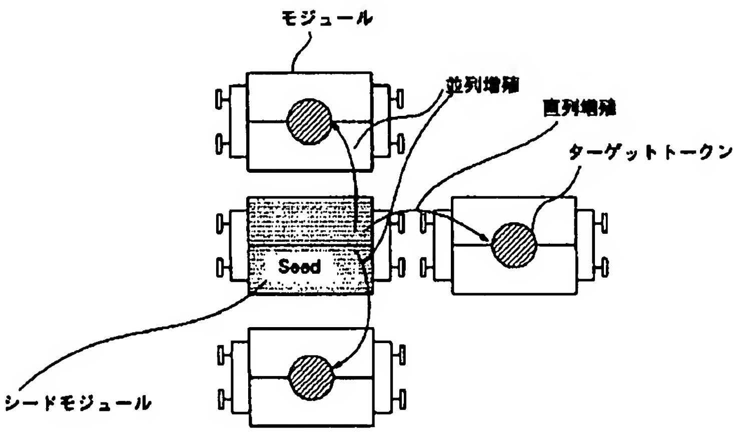
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

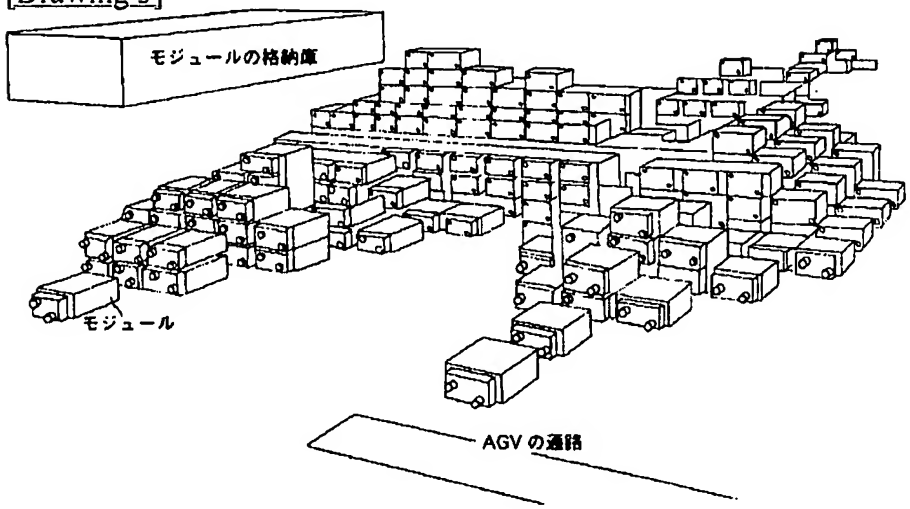
[Drawing 1]



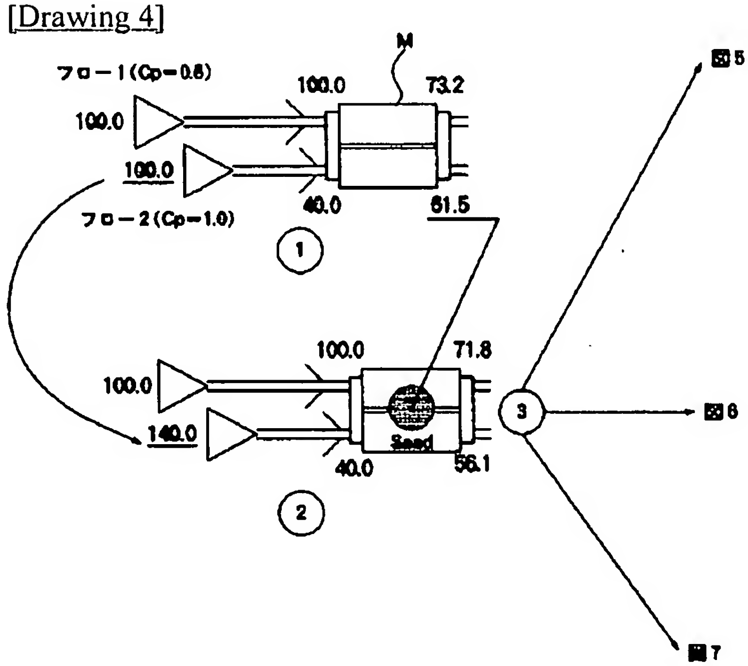
[Drawing 2]



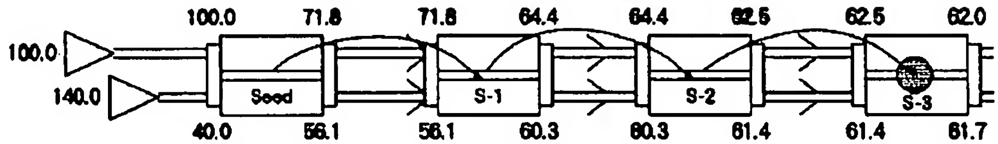
[Drawing 3]



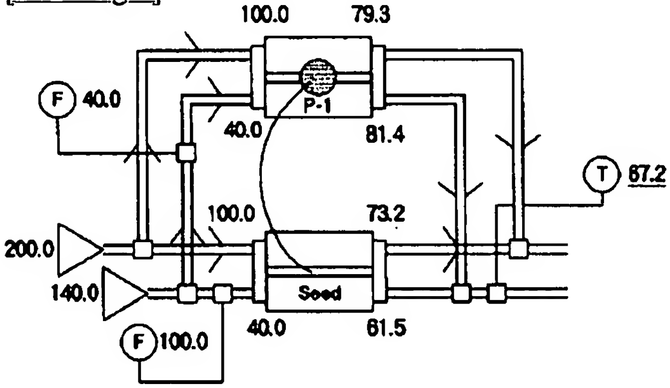
[Drawing 4]



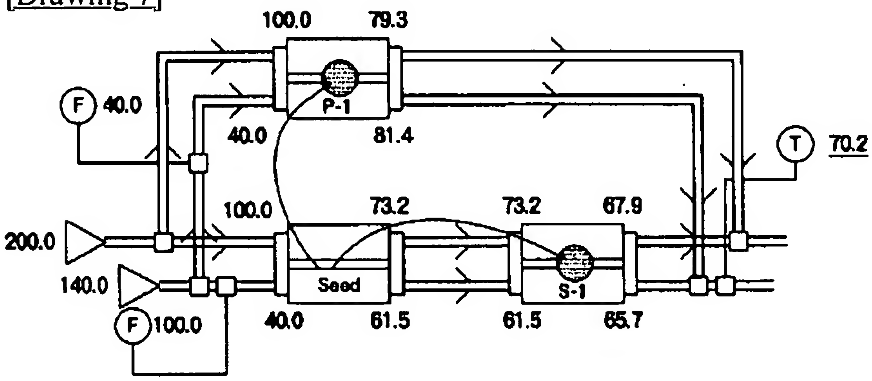
[Drawing 5]



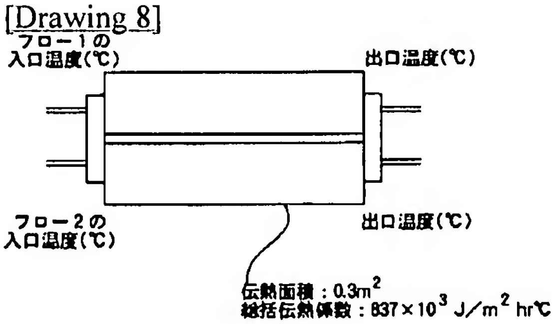
[Drawing 6]

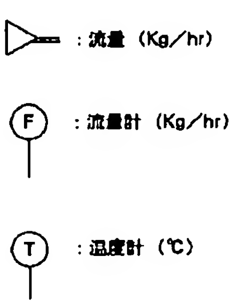


[Drawing 7]



[Drawing 8]



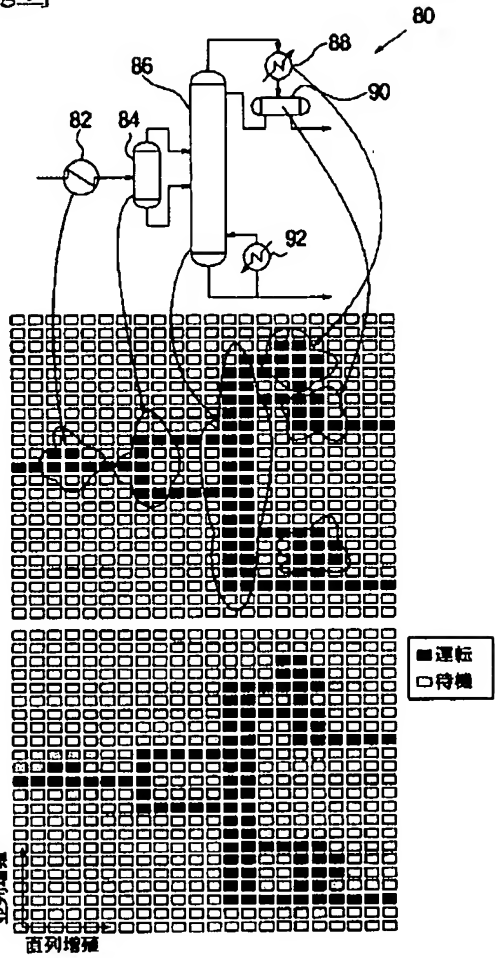


[Drawing 9]

(a)

(b)

(c)



[Translation done.]